TIGHT BINDING BOOK

Preface

During the last two decades, out of the varied efforts of specialists in many fields, including anthropology, human geography, sociology, psychology, psychiatry, economics, political science, social work, and business and governmental administration, a new field of science has come to be defined —that of *human relations.* Although the differences in the terminology and scope of the parent fields are extensive, the realization is growing that all are concerned with the same general problems, and that workers in each field must know about and be prepared to use the methods and results of the others.

The speed with which this new science of human relations can develop will depend almost entirely upon the length of time it will take for the traditional barriers between these subjects to be broken down. This will depend in turn upon the ability of the workers concerned to accept and to practice the basic rule of scientific procedure—that specific methods and principles must be devised and followed in the solution of each concrete problem.

In the history of science, this rule has seldom been observed at the beginning. In fact, the principles by which the interrelations of phenomena are predicted, and are thus made subject to human control, have been discovered largely through the pursuit of the practical requirements of living. For this reason the engineering side of the sciences was the first to develop, and people have long busied themselves with surveying, mechanics, navigation, and the manufacture of explosives. In the same way medicine, since its primary concern is curing, was the first branch of the science of living organisms to arise. Thus the theoretical sciences of physics, chemistry, and biology arose only when the principles implicit in them were discovered through practice.

The same is true of the science with which we are immediately concerned, that of human relations. The first great advances in our knowledge of this subject were likewise made in the course of application, particularly in administration, psychiatry, and social work. In each case, however, the specialist was hampered by the fact that he was dealing with a limited range of the

total phenomena. So great was the separation between these various disciplines that those who practiced one of them were usually unaware of what went on elsewhere, and even if they knew something about the other subjects, they were unable to apply the results to their own problems.

It was not until the development of anthropology as an applied science that a synthesis became possible, for anthropology alone provides a common meeting ground for all of the different subjects which have, in the past, dealt with human relations. The reason for this can only be understood when we know something of the history of anthropology.

Anthropology, as a learned discipline, is little more than one hundred years old. During the greater part of the last century it has served as the "unclassified" bin in many academic filing cabinets, a place in which to put odds and ends of information which could not be pigeonholed elsewhere. It has also served as a source of "interesting" information about the so-called "primitive" peoples, particularly useful as dinner-party conversation.

Even while this attitude was generally held, however, anthropology had the advantage over other disciplines of a point of view which is comparative both in time and in space. The generalizations which could be made from it bore, for that reason, the authority of an essentially relativistic attitude. The range of complexity in civilization provided by such peoples as the Andamanese and Eskimo at one extreme and the Hindus and Chinese at the other made for an objective evalution of the phenomena of human relations, but most anthropologists hesitated, except occasionally in an off-the-record manner, to apply the results so obtained to our own civilization, which they considered too complex or too difficult to study, or which some even thought to be qualitatively different from the others. With the most abundant of all sources of evidence ruled off the field, anthropology was at that stage primarily a luxury product, because anthropologists failed to test their generalizations against the workings of our own society.

Even with this disadvantage, however, a change began to take place some two decades ago, when a number of persons in positions of authority began to realize that anthropology can be used in colonial administration, in the specific field of regulating the relations between whites and the so-called "primitive" peoples. One of the earliest agencies to make this discovery and put it to practical use was the British government, which made a ruling that colonial administrators working with native peoples must be trained anthropologists. It is extremely fortunate for the government and for the natives as well that many of the men who came under this ruling were taught by Professor Bronislaw Malinowski. A second example is the use by the Indian Bureau of anthropologists trained in this country.

The next step in the broadening of the field was the realization that what will work with the primitives should also hold good in our own society. It was the great contribution of Professor W. Lloyd Warner of the University of Chicago, and formerly of Harvard University, that he put this idea to the test, and extended the field of anthropology to include ourselves. He believed that the methods of field work used by anthropologists, as for example those which he himself employed on the Murngin of Northern Australia, could be used not only to obtain a detailed knowledge of the life of a primitive group, but also, with equal ease and much greater profit, in the study of an American or European community. He was able to carry his ideas into practice by instituting and directing the studies of Newburyport, Massachusetts, Natchez, Mississippi, and County Clare, Ireland. His was also the principal influence in securing the adoption of anthropological methods in the Western Electric Company study, described by Professor F. J. Roethlisberger of the Harvard Graduate School of Business Administration and W. J. Dickson, of the Western Electric Company, in *Management and the Worker.*

Since Warner's pioneer work, anthropology, as mentioned earlier, has become a general science of human relations; all peoples are included in its view as part of its subject matter. It is thus comparable to any other general science in the scope of its interests, in that it is concerned with the investigation of all instances of a particular type of phenomena. At present it has come to be used in a wide variety of political fields, of which the most notable is its application to administration problems in the United States Department of Agriculture under M. L. Wilson.

This book is an attempt to describe explicitly and systematically the principles of anthropology as we know them in the year 1942. These principles have been tested both on material from primitive groups and on that from our own civilization. In most cases they have also been tested in applied work both on individuals and on groups. The basic point of view which we have followed was first stated in the monograph, *Measuring Human Relations,* which was written by E. D. Chapple in collaboration with Conrad M. Arensberg. This was, in turn, derived from the work of the so-called "functionalist" school, led by Malinowski, Radcliffe-Brown, and Warner, but modified by an insistence on operational procedures and the use of *time* as the measure of human relations.

For the last twenty years, most anthropologists have been divided into two camps, although some would acknowledge membership in neither. These two groups were the functionalists, mentioned above, and the adherents of the "historical" school, which included the majority of the

American anthropologists, and particularly the students of Boas. Although the functionalists, as their name indicates, are best known for their emphasis upon the interrelation of phenomena in a society, their greatest contribution, in our opinion, has been the realization that human institutions are founded upon and must be explained in terms of the behavior of human beings as organisms. Malinowski is responsible for much of this, in that he defined institutions in terms of the relations of people, which in turn are based upon physiological mechanisms. Radcliffe-Brown's share lies chiefly in his demonstration that many symbols and forms of social life (magical, religious, familial) can be explained in terms of the operation of the physiological mechanisms of conditioning. The American anthropologists who belong to the historical school have been primarily interested in explaining cultural change, and have been little interested in the interrelations of the activities of individuals within a single group.

The functionalists have rightly pointed out the weakness of the historical approach as ordinarily practiced, particularly when bits of behavior have been isolated from their contexts in the interrelated behavior of a people. The members of the historical school have rightly pointed out, in their turn, that the functionalists have a static notion of society, and that interrelations at a fixed point of time give us little information which we can use as a basis of prediction.

During recent years, however, the separation between these two schools has become much less distinct. Anthropologists are beginning to realize more and more that each point of view has its merits, and that if we are to use the analytical methods of the functionalists, we should do this with the yardstick of time. Even Radcliffe-Brown, perhaps the most extreme of the functionalist old-guard in maintaining what he calls a "synchronic" position, was led to work out a developmental sequence for changes in the Australian family system, from a simple Kariera type to the extremely complicated form found among such groups as the Murngin, described by Warner. He pointed out, of course, that there was no historical evidence, i.e., dated evidence, in Australian history to support his findings, but his study made it clear that the variation in family systems in Australia can only be explained in terms of historical forces.

This historical yardstick is, of course, the measurement of elapsed time. It is our purpose to show in this book that the use of the time scale is the basic method of measuring human relations, and that only by this method can we formulate changes in societies so that we will be able to make predictions. This book is, therefore, as the reader will discover, the result of an attempt to explain the phenomena of human relations in terms of their

changes in time, and it is thus both "functional" and "historical" in outlook. It must be made clear at the beginning that we regard anthropology not as a mere dating of events in a sequence, but as a science of human relations, a science in which the variables are the properties of human beings and the various elements of their environment, while the measures to be applied to the relations between these variables are units of time.

We have, therefore, tried throughout to follow the techniques of science, in order to present a systematic analysis of the phenomena with which we are concerned. In accordance with this decision we have limited our attention to facts which can be ascertained directly from observation, and we have tried to show at each point how these facts can be observed. We have made no assumptions about human behavior which we cannot verify, and we have discarded the subjective interpretations of others. We believe, therefore, that the interpretations which we have made consist of objective descriptions of the facts.

In accordance with this point of view we maintain that it is better to start off the beginning student in any subject with a purely objective, scientific approach than to make him memorize a mass of unrelated "facts" and a number of subjective theories which he will have to discard later. The beginner should, in our opinion, be given the same methods and principles to work with as the professional, and above all what he learns should make sense to him. It is for this reason that we have tried to write this book in such a way that it will be of service to beginner and professional alike.

We believe that if the reader, whatever his special interest may be, will follow the techniques and principles which we have outlined he will come out with the same results as we did, no matter what society he studies, nor whether he secures his data directly in the field or uses facts accurately observed by others. We further believe that, since the final test of any formulation lies in the controlled observation of the relations between phenomena, these techniques and principles may be of use not only in studying and understanding human relations, but also in doing something about them. It is our sincere hope, therefore, that these methods and principles can be used to help people to make more successful adjustments to the conditions of their existence, both as individuals and as groups.

In the work which we did in preparing to write this book, as in its actual composition, we were aided, either directly or indirectly, by many people. Both of us received our earliest training in cultural anthropology under Alfred M. Tozzer and Roland B. Dixon. To the former we are specifically indebted for his recognition of the value of Van Gennep's little appreciated work on the Rites of Passage, and for his own discovery that

magic is the technique of religion. To the late Roland B. Dixon we owe the basis of our systematic method of describing technology and our primary realization of the role of environment in the building of human cultures.

The most immediate influence, however, on our approach to the study of human behavior is that of Malinowski, Radcliffe-Brown, Warner, and Lowie. In a derivative sense the works of Georg Simmel and Émile Durkheim have also played a part. In a number of other fields, equally strong influences are to be found, such as those of Preston James and Derwent Whittlesey in geography, and Dr. Walter B. Cannon and Ivan Pavlov in physiology. In the latter field we have also been stimulated by the work of T. J. B. Stier, Hudson Hoagland, and Charles F. Harding III. In psychiatry we owe much to the association of one of us with Dr. Erich Lindemann. Our method of dividing all techniques in terms of instruments, forces, actions, and interaction, which we have used in our analysis of technology, was initially derived from Julius Lips' work on traps, in which he isolated the first two of these elements.

In the actual writing and revision of the manuscript we have derived much benefit from the help of several persons. Of these the first and foremost is Professor Conrad M. Arensberg, of Brooklyn College, who had much to do with the original formulation of the principles expounded here, and who read and criticized the manuscript. Dr. Douglas Oliver, Dr. Charles F. Harding III, and Dr. Preston E. James have also read and criticized various parts, and we are particularly grateful to all three of them, not only for this service, but also for permission to use their own works, from which we have drawn extensively. The general attitude which we have adopted toward the methods of science has, however, been derived in large measure from our constant personal association with Dr. William J. Crozier, of the Harvard Biology Department, who has stimulated us more in our effort toward objectivity than any other person.

The maps and diagrams in this book were drawn by Elmer Rising, who helped us both as an artist and as a collaborator in our effort to devise ways of expressing the relationships of our data in the two dimensions of the printed page.

E. D. C.
C. S. C.

Harvard University
Cambridge, Mass.
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PART I

Biology and Human Relations

CHAPTER 1

The Operational Method and Anthropology

In beginning a book on anthropology, it is customary to state that anthropology is the study of man. This etymological definition, however, is too general to be of much service. No anthropologist studies every aspect of man, as an object in space and time, nor shall we attempt it here. One of the first efforts that a person must make in science, as in anything else, is to define what he is talking about. That is what we shall try to do in this chapter.

In drawing up the plan of this book, we had to make a choice between concentrating on certain of the traditional areas of study and looking at man as a whole, and, in the latter case, delimiting the boundaries of our field of study on the basis of the facts which we might choose to observe, no matter where the investigation might lead us. It is the latter course which we have tried to follow, since we believe that we can, by this means, define a field of investigation which is capable of being studied by the methods of the natural sciences.

In going about the task of defining our subject of investigation, we shall be guided by rules of scientific procedure. That is, we shall try to limit ourselves only to that which can be observed and described objectively. What this means, we shall see in detail a little later. Here, however, we intend these terms to be taken in the common meaning; in other words, we shall try to describe as carefully as we can, and as our sources will allow, those aspects of man which we define as anthropology.

Most people who call themselves anthropologists have been interested in studying man's behavior and his institutions. They have gone about this in a wide number of ways, but they have all had in common the fact that they were trying to discover some rational explanation for the diversities in action of which man has been capable. Up until fairly recent times, most of these students have concentrated on the so-called primitive or non-European peoples, and by patient description and comparison, they have endeavored to work out generalizations which would apply to these peoples.

During the last few years, however, most anthropologists have realized that a general study is somewhat inconclusive when it omits from examination European, or modern, or civilized peoples, whichever word one wishes to apply. The truth of this became evident from the obvious fact that if anthropologists are to develop any rules which hold for primitive peoples, they will also hold for our own society as well. The result of this realization has been to make anthropology the study of all kinds of people.

This was not, however, the only consideration that led anthropologists to include so-called civilized man within their province. They also came to realize that the purpose of any science is to obtain generalizations which will provide a basis for modifying the old or building the new, and that therefore anthropology might be of some practical use. At first this new attitude was confined to the area of helping Indian agents and colonial administrators obtain more equable adjustments for the "primitives" under their charge, but soon it came to be realized that we are in equal need of humanitarian attention ourselves. This realization, which has appeared only within recent years, arose at precisely the time when the relatively stable way of life with which the older anthropologists were acquainted was beginning to disintegrate with extraordinary rapidity. When this happened there was a general agreement between observers that although we have attained a remarkable competence in dealing with our environment through the development and application of physics and chemistry, we are still, on the human side, as ignorant and incapable of controlling our own destinies as our most primitive contemporaries. Thus in recent years the field of human relations has been wide open, and anthropologists, as well as many others, have become active within it.

The extension of the interests of the traditional anthropologists into the field of modern society does not, however necessary it may be, serve to define the field of anthropology. In science, a field of study is one which possesses a specific characteristic known as *functional dependence.* Unless functional dependence is exhibited by the subject matter, scientific methods cannot be applied.

Functional dependence is exhibited when there is such a relationship between phenomena that a value of one variable changes uniformly with changes in another (x varies as a function of y). A simple example is that of a thermometer. Here the temperature is one variable and the volume of mercury is another. As the temperature increases, the mercury expands (rises); as the temperature drops, the mercury contracts (falls). The value of one variable (temperature measured in degrees Fahrenheit) changes uniformly as a *function* of the other variable (the volume of the mercury).

The aim of science is to discover such relationships and to work out the precise nature of the functional dependence. This has been well put by A. N. Whitehead in his classic work, *An Introduction to Mathematics,* from which we quote:

Consider how all events are interconnected. When we see the lightning, we listen for the thunder; when we hear the wind, we look for the waves on the sea; in the chill autumn, the leaves fall. Everywhere order reigns, so that when some circumstances have been noted we can foresee that others will also be present. The progress of science consists in observing these interconnections and in showing with a patient ingenuity that the events of this evershifting world are but examples of a few general connections or relations called laws. To see what is general in what is particular and what is permanent in what is transitory is the aim of scientific thought. In the eye of science, the fall of an apple, the motion of a planet round the sun, and the clinging of the atmosphere to the earth are all seen as examples of the law of gravity. This possibility of disentangling the most complex evanescent circumstances into various examples of permanent laws is the controlling idea of modern thought.

Now let us think of the sort of laws which we want in order completely to realize this scientific ideal. Our knowledge of the particular facts of the world around us is gained from our sensations. We see, and hear, and taste, and smell, and feel hot and cold, and push, and rub, and ache, and tingle. These are just our own personal sensations; my toothache cannot be your toothache, and my sight cannot be your sight. But we ascribe the origin of these sensations to relations between the things which form the external world. Thus the dentist extracts not the toothache but the tooth. And not only so, we also endeavor to imagine the world as one connected set of things which underlies all the perceptions of all people. There is not one world of things for my sensations and another for yours, but one world in which we both exist. It is the same tooth both for dentist and patient. Also we hear and we touch the same world we see.

It is easy, therefore, to understand that we want to describe the connections between these external things in some way which does not depend on any particular sensations, nor even on all the sensations of any particular person. The laws satisfied by the course of events in the world of external things are to be described, if possible, in a neutral universal fashion, the same for blind men as for deaf men, and the same for beings with faculties beyond our ken as for normal human beings.

But when we have put aside our immediate sensations, the most serviceable part—from its clearness, definiteness, and universality—of what is left is composed of our general ideas of the abstract formal properties of things; in fact, the abstract mathematical ideas mentioned above. Thus it comes about that, step by step, and not realizing the full meaning of the process, mankind has been led to search for a mathematical description of the properties of the universe, because

in this way only can a general idea of the course of events be formed, freed from reference to particular persons or to particular types of sensation. For example, it might be asked at dinner: "What was it which underlay my sensation of sight, yours of touch, and his of taste and smell?" the answer being "an apple." But in its final analysis, science seeks to describe an apple in terms of the positions and motions of molecules, a description which ignores me and you and him, and also ignores sight and touch and taste and smell. Thus mathematical ideas, because they are abstract, supply just what is wanted for a scientific description of the course of events.[1]

If the concern of science is the abstract general properties of phenomena, the description of functional relations between variables, then we must ask whether or not we can define for anthropology a field where these properties obtain. That means we must ask in a preliminary way in this introduction to the Principles of Anthropology how, out of man's varied activities, we can define a field which possesses this property. The answer is that it can be done only by observation.

If, then, we turn to observation of man's behavior in his varied institutions and elsewhere, we observe that there is one field out of several where functional dependence does exist and play an easily demonstrable part. This field is that of human relations, that is, the way in which human beings affect each other. Any brief acquaintance with man, or for that matter with the lower animals, will convince anyone that functional dependence is characteristic of the relations of individuals. A change takes place in one relation of a person and changes follow in his other relations. A foreman orders a man around all day; the man goes home and rails at his wife. The pupils in a class are inattentive and fail to respond when the teacher speaks; the teacher gives them a lecture. An increase in the number of customers coming into the store increases the amount of supervision of the clerks by the executives. All these are simple cases of functional dependence, and they can be paralleled from every group. It is, therefore, possible for us to define a science of human relations, and this is what we mean by anthropology.[2]

In the rest of this book, we shall be concerned with the principles un-

[1] Whitehead, A. N., *An Introduction to Mathematics*, pp. 11-13, Henry Holt, New York, 1921.

[2] There are other definitions of anthropology. Comparative human anatomy, which is called physical anthropology or somatology, is sometimes called anthropology, but this nomenclature is largely confined to Europe. The functional dependence here consists of the relationships between the gross (bone and muscle) parts of the body. As we shall see later, such limited definitions as that restricting anthropology to culture are included within the field of human relations.

tions, we shall have to use operations which can describe these relations. Obviously, many operations in use in physics and chemistry could be applied. We could measure the height and the weight of an individual, his metabolism and temperature; the problem, however, that we have to face is, what operations will actually tell us something about the phenomena with which we are to deal? There is no use measuring every aspect of a man in his relations with others. Many measurements that we might think of may not apply. The first thing we must do after we have hit upon a few operations that may be used is to see whether they tell us anything. If they don't, we had best discard them from our operational apparatus.

Galileo faced a problem of this sort in his famous experiments performed from the top of the Leaning Tower of Pisa. His interest, as we all know, was in the problem of falling bodies; he wanted to discover the functional relationship between the weight of a body, its speed, and the distance it fell. By dropping a cannon-ball at different distances from the ground and timing its arrival with a small hour glass, he was able to work out the law of falling bodies. Nevertheless, this gave him a relationship only between distance and the rate of falling; he still had to test to see if there was a relationship with weight. It was the popular belief at the time that a heavy body would fall more rapidly than a lighter one; but two cannon-balls of unequal weights fell to the bottom of the Tower at approximately the same time. This showed that there was no functional relationship between weight and the time of falling or the distance, and the weighing operation could thus be eliminated from consideration. Similarly, other variables, like texture, color, and so on, all of which might be measured with great precision, could be shown to be irrelevant to the purpose at hand.

Once we hit upon operations, therefore, which seem to have some significance, we have to test to see which are important in defining functional relationships, and which can be disregarded. We test the significance of a particular measurement by the success with which our formulation defines the phenomena in question. Thus if we test the formula with as great accuracy as our instruments are capable of, and find that the answer comes out just as predicted, we know that some other operation can be eliminated. If we find, however, that there is a constant error, then we assume that some other factor which we have not yet been able to measure enters into the situation. Only if our formulas, our equations, by which we express the relationship between variables, do not accord with the observations, are we justified in bringing in other measurements, and in trying to get a new formula which will fit the facts more accurately.

In science, however, we have to work within the range of error of our operations. In much of what follows, for example, the evidence which seems to indicate functional relations is insufficient for anything more than a statement that such a relationship seems to occur, and that it tends to move in one direction or another. This does not mean, however, that we are dealing with matters incapable of scientific treatment. What it does mean is that much of what we have to say is merely a guidepost to more precise formulations. All sciences proceed by the method of approximation; they define the range of accuracy of their formulations *within the limits of error of their operations.*

For many purposes, great accuracy is of little use in obtaining results. Thus a man who wants to measure a length of board to fit in a particular partition works within a range of about 1/16th of an inch. A micrometer capable of measuring down to 1/1000th of an inch would be of no use whatever. Many of the most important generalizations of science were made within very crude limits of error. Later work can test the generalization and make it more precise. But the most important work is done in the first roughing out of the relationship for later generations to test. Much effort has been wasted in the study of man by people who were trying for accuracy which their data would not provide. Conversely much effort has been wasted by people who failed to use accurate methods which were at hand, believing that intuition and subjective judgments were a satisfactory substitute for objective operations. In general, a safe rule to follow is to work within the limits of error which give the greatest amount of information for a given amount of expended time. At an early stage of an investigation, rough methods are necessary; greater precision is useful later in testing one's preliminary results.

These considerations, however, do not alter the fact that *some* operation has to be used to describe any type of phenomena. Unless objective description is possible, there is no way for others to repeat the same observations and obtain comparable results. Every scientist first inquires what an individual did to get his results; if this operation cannot be performed by others, the scientist rightly concludes that any generalizations so produced are not worth bothering with, *unless* he can see a way of developing other operations with which to tackle the problem.

On the other hand, the scientist also knows that he cannot criticize the results of other people unless he can show operationally that a mistake was made, or that other *objective* data which could have been measured, and were not, invalidate the results. Moreover, the burden of proof is always on the man who tries to adduce intuitional rules for disagreeing with

a formulation. The intuition may be correct, but only operational proof will demonstrate the fact. Most arguments dealing with human relations are irrelevant for this reason, simply because no attempts are made by the disputants to ascertain the facts in a manner in accord with scientific standards.

One further caution has to be mentioned. One of the arguments frequently brought up by the naive, or by those who insist that a science of human relations is impossible, is the statement that in human relations the same circumstances never recur and therefore science cannot exist in the field. Yet such a situation is the rule in much of physics and chemistry. The same piece of metal is not used repeatedly in experiments dealing with the effect of temperature on the molecular composition of iron, since temperature changes affect its molecular constitution. Rather what is done is to specify operationally the similarity in molecular constitution of another piece of iron and then to repeat the experiment. Provided that there are operations by which these initial conditions can be specified, the observation can be repeated and the results checked. As we shall see, the same considerations apply in the field of human relations.

Conclusion. The success of a science depends upon the degree to which those who employ it are able to predict what will happen within the field with which it is concerned. In other words, when its formulations are tested in experience, they actually work—in all cases, that is, where predictability is demonstrable. It is not enough that they work some of the time; they must work all the time, and if they fail to work, there must be some definite measurable variable which is upsetting the predicted course of events. If we go into a room and turn on a light switch, we expect, on the basis of past experience, that the light will go on. If it does not, we do not conclude that the behavior of electric light is unpredictable; rather we are sure that some other variable, such as the fact that the current is turned off, the switch is broken, or a fuse is blown out, is upsetting the functional relationship of turning on the switch and seeing the light go on.

In the same way, as we shall see, human relations possess the characteristics of regularity and predictability. A man and his wife quarrel under given conditions, and the violence of the quarrel and its results can be and are foretold by most of us with precisely the same kind of reasoning which we apply in the case of the electric light. Was this quarrel more serious than the last? We carefully go over the actions, and consider the other individuals who are involved and the proximity of previous quarrels, and then we make our predictions. If we forget, in one case, that the filament in the lamp was broken or, in the other, that the man's mother-in-law was

present during the argument, we may leave out an important variable which will upset the success of our predictions. But, as we hope to show in this book, the same reasoning and the same methods that can be applied to one science are applicable to all. The operations may differ in accordance with the phenomena with which they deal, but the scientific procedures are the same in all cases.

In this book, then, we intend to follow the methods of science in ascertaining the Principles of Anthropology. In order to do this we shall give particular attention in the rest of Part I to the properties of organisms which determine the functional dependence in the relations of human beings to one another. Much of this may seem to be unnecessarily detailed, but it is our belief that without an understanding of the physiological properties of human beings, we cannot expect to understand the reasons for the functional dependence with which we shall be concerned later on.

Much difficulty in the field of human relations could have been avoided if more attention had been paid to what was actually known about the workings of organisms. Whether we get along with people or not, whether we are able to adjust to others, whether we can lead or follow, whether we become emotional under criticism, in fact, all the realities of our own experience which we feel subjectively, have been worked out objectively in the physiological laboratory. The understanding of the mechanisms involved will make it easier later on to understand the ways in which groups of people adjust to their environments, develop institutions, and during the course of life undergo changes which make up what we usually refer to as history. If we are interested in prediction, we must know how human beings respond to their environments and what effects changes have upon them and upon those with whom they are associated. This knowledge can only be obtained by studying man as an organism.

SUMMARY

Anthropology is the study of human relations. It is our purpose to apply the techniques of science to this study. If we are to do this we must consider all kinds of people, "primitive" and "civilized" alike, since any rules that apply to one will apply to all.

In every field of science the object of the investigator is to discover and describe *functional dependence,* which is the relationship between phenomena in which a value of one variable changes uniformly with changes in another. Before we can do this we must devise objective methods of measuring the phenomena with which we are concerned. These methods are known as *operations.* We must furthermore measure only those variables

which vary significantly, i.e., exhibit functional dependence, in the area of study with which we are concerned.

Human relations, or the interaction of individuals with each other, exhibit the characteristics of functional dependence. When a change takes place in one relation of an individual, other changes will follow in his other relations. It is human relations, then, which we intend to study by the operational method.

The key to this study lies in the observation of the physiological properties of the human organism, since human relations are in turn a function of the workings of the human body. These phenomena can be observed by means of operations already worked out in physiological laboratories, and by others especially devised for the purpose.

The understanding of the mechanisms of human adjustments, i.e., human relations, will make it possible for us to understand further, as we proceed, the ways in which groups of people adjust to their environments and develop institutions.

CHAPTER 2

The Physiology of Emotion

I. THE MAINTENANCE OF EQUILIBRIUM

All organisms, human or otherwise, must continually adjust themselves to changes in their environments. These changes are constantly occurring, and the responses which we, as organisms, make to many of them take place without our knowledge. We are continually subject to changes in temperature, changes in the intensity of light, and changes in the gravitational stresses of the earth which we must counterbalance in order to maintain our erect posture. Our responses to these changes might involve profound modifications in the physiological working of our bodies, if our bodies had not developed methods of maintaining a balance, or equilibrium, by means of which they are able to preserve a constant internal environment.

In man, as in other mammals, the body maintains a constant temperature through the development of a heat-regulating mechanism, and thus, within limits, it is not compelled to readjust itself to every minor change of external temperature. When the body is subjected to high temperatures, these heat-regulating mechanisms begin to operate by causing the body to sweat; this is the most easily observed of the several changes that take place. When, on the other hand, the body is subjected suddenly to low temperatures, the blood vessels in the skin contract, causing "gooseflesh."

A more dramatic example of equilibrium occurs when a sudden flash of light strikes the eye. The pupil immediately contracts, and the eyelid closes. In the complex set of events which produces this reaction, the impulse travels almost instantaneously from the end-organ over nerve paths to the responsible part of the brain, and thence back to the circular contracting muscles, thus protecting the eye from danger to the sensitive nerve ends, which, if burnt, might cause blindness.

The primary purpose of responses of the kind just described, which are usually grouped under the term "reflex activity" is to maintain a constant internal environment. Without these responses, overly wide contrasts in the external environment of the organism, as, for example, in temperature,

would prevent the organism from working. The changes in the bodily activities which maintain these constant conditions involve the interrelationship of the brain, nerves, heart, lungs, stomach, intestines, bloodstream, muscles, and other parts of the body, including the endocrine system. It is the mutual relations which are set in motion between these organs in response to external stimuli which make up the balance of forces which we call an equilibrium.

Equilibrium may be defined as a state in which, if a small force is impressed on a system, the force will produce modifications to a greater or lesser degree within the system, and when the force is removed, the system will tend to return to its previous state.[1] Such a restoration of equilibrium may be illustrated by the example of the eye, given above. A bright flash of light strikes the retina. This force, which disturbs the balance of the system, causes an immediate contraction of the pupil, and a partial or complete closure of the lids, these actions being the accommodation, or modification, of the system to the stimulus. When the stimulus is removed, that is, when the flash of light is over, the eyelids open and the pupil expands to its former size.

This example involves merely a single flash of light. Very frequently, however, the disturbance may last a considerable length of time. A man coming out of a dark room into bright sunlight undergoes these changes, which will last as long as he remains in the intense light. Habitual subjection to extreme conditions of light, temperature, sound, or motion, may bring about permanent changes in the physiology of the individual. For example, blue-eyed Riffians, who live in a country of intense light and whose retinas contain but little protective pigment, habitually squint.

The stimuli which produce major changes in the equilibrium of the individual are of three types: (1) stimuli of high intensity, (2) sustained stimuli, (3) repetitive stimuli. Examples of these are:

1. A thunderclap, a blinding flash of light, a sudden blow, contact with fire.

2. An animal caught by the leg in a padded steel trap, but uninjured (such an animal is subjected to a continued tactile stimulus to which he must make an adjustment); the continuous flood of bright sunlight to which the Riffian, mentioned above, is subjected during a day of marching; the traffic roar of which a visitor to New York is immediately conscious.

[1] Technically, a distinction is made between a steady state and a state of equilibrium, and the latter is usually applied only to thermodynamic systems. However, we shall use the term "equilibrium" throughout this book because of the familiarity of most readers with it, but we are quite aware that the term "steady state" is the correct one.

3. A barking dog which disturbs the midnight slumbers of all within earshot; the Chinese water torture, in which drops of water fall at regular intervals upon the forehead of a prisoner; the lights of automobiles rising over a hill and flashing repetitively into the windows of a roadside house, disturbing its occupants.

Emotions. The reactions which we observe in ourselves and in all higher animals to disturbances of the types listed above are ordinarily called "emotions." We are afraid, we are angry, we suffer pain, we are hungry, or we love, and our experience of these emotions is, in fact, made up of changes which take place in our internal environments. Ordinarily, people who feel an emotion are not fully aware of the exact sequence of the stimuli which produce it, but rather think of the last stimulus in the sequence as the cause of the emotional experience. A classic example is the story of the straw that broke the camel's back. People who discuss their emotional lives attribute their reactions too frequently to the final straw that was added, and not to the entire load.

Differences of emotional feelings in the individual are produced by differences in the intensity, length, and frequency of the sequences of stimuli. It is only our habits of speech that make us use separate words to express these differences of feeling as mutually exclusive concepts. For example, respect, fright, and terror are all quantitative aspects of the emotion of "fear"; liking, affection, and devotion are similarly expressions of degrees of "love."

These differences in emotional feeling are often expressed in terms of the person or object toward whom they are directed. We speak of father-love, mother-love, love for children, marital love, and love of a king or leader, as if they were separate forms of emotion. Our habits of speech and the fact that different people or symbols are involved make us believe that we are experiencing different emotions in all these cases, but a study of the actual physiological happenings shows that in each case the same set of events is taking place.

When the physiologist in his laboratory tries to work out a precise description of the reactions of the body to stimuli such as those which we have described, he cannot rely merely upon his own impressions, but he must develop techniques of measuring physiological responses, not only to determine what changes have taken place, but also to evaluate them on a quantitative scale. In order to observe the precise nature and extent of these disturbances of equilibrium, he measures the physiological events which, as observation has taught him, occur in response to stimuli.

Let us give an example of such a set of events. An animal is frightened

or made angry. Certain obvious changes, which anyone can observe, now take place. The animal's heart beats more rapidly, his breathing rate becomes faster, and his digestive process stops. With these changes, the activity of his skeletal muscles increases. The animal becomes excited; his movements increase in rapidity. Under these altered conditions, he is able to undertake great effort and sustain prolonged activity. The changes described above are part of the response of the animal's autonomic nervous system to environmental disturbances. Most of these changes, including heart-beat and respiration rate, may be accurately measured. To understand behavior, therefore, and particularly its emotional concomitants, we have to understand the operation of the nervous system.

II. THE NERVOUS SYSTEM AND BEHAVIOR

The nervous system, which we will now study, may be conveniently divided into three parts: (1) the Central Nervous System, (2) the Somatic Nervous System, and (3) the Autonomic Nervous System.

The central nervous system is made up of the brain and the spinal cord. Since it does not concern us directly here, we will discuss the part that it plays in emotional activity later. The somatic nervous system controls the overt movements of the skeletal muscles, including those of the arms, legs, trunk, and face. The nerves which make up this system connect the nerve fibers of the skeletal muscles with the central nervous system; they control not only such voluntary activities as the flexing of arm muscles, but also such involuntary, or reflex, activities as the movements of the limbs which take place in rage. The third division of the nervous system, the autonomic, is for our purposes the most important for the understanding of emotion. This system controls the involuntary, and for the most part unconscious, activities of the viscera. These activities include the movements of the heart and of the gastro-intestinal tract, the flexing of the smooth muscles of the blood vessels, bladder, bronchi, and skin, and the secretions of the various glands.

The Autonomic Nervous System. The autonomic nervous system may itself be divided into three parts, which are represented diagrammatically in Figure 1. These three divisions are (1) the Cranial, (2) the Thoraco-Lumbar, and (3) the Sacral. The thoraco-lumbar division is also called the *sympathetic system,* while the cranial and sacral together form the *parasympathetic.* The parasympathetic system is concerned with maintaining the equilibrium of the body as it performs its normal activities, such as eating, drinking, digesting food and eliminating waste matter. The sympathetic, on the other hand, is concerned with the reaction of the organism to stimuli

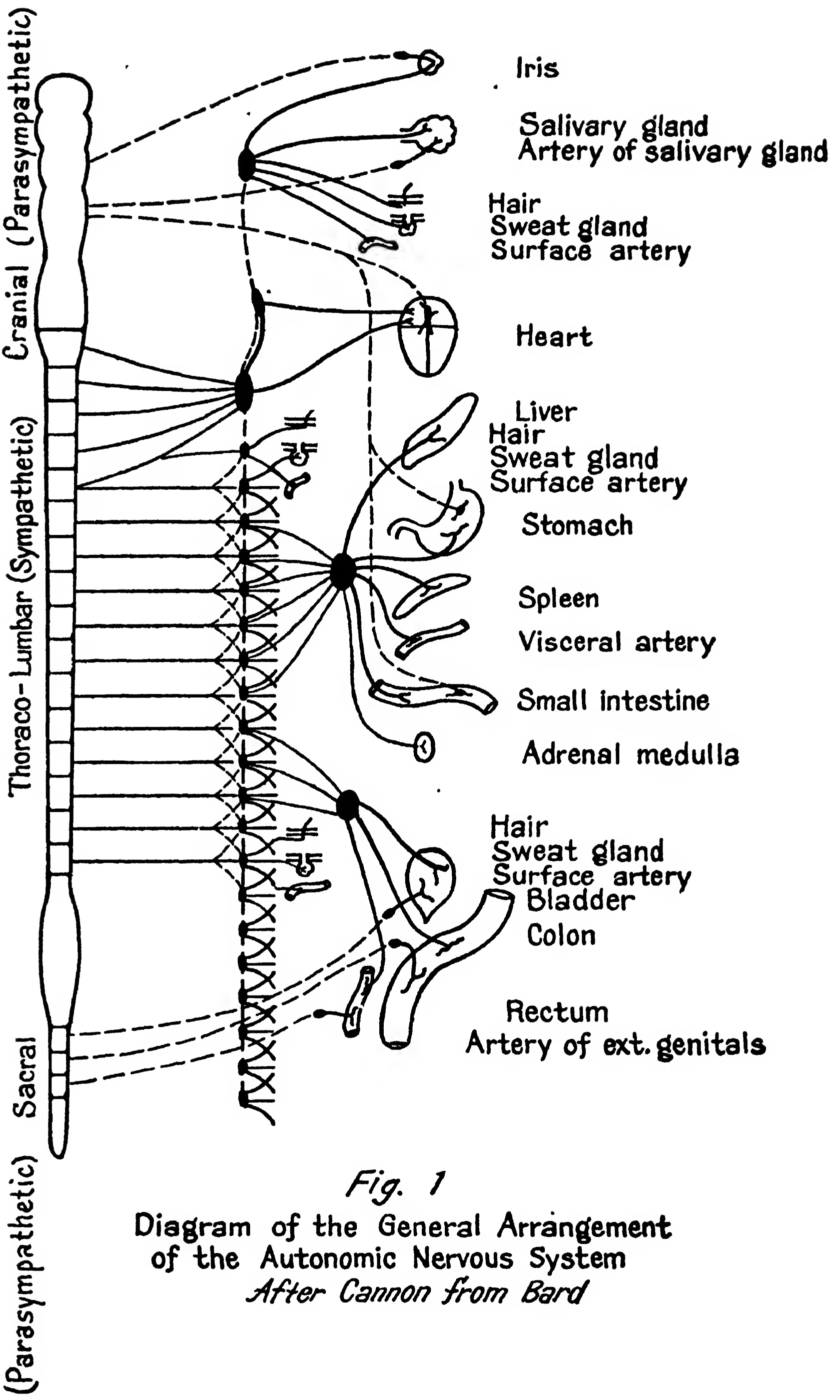


Fig. 1

Diagram of the General Arrangement of the Autonomic Nervous System
After Cannon from Bard

which are felt during periods of crisis; it arouses the more intense emotions, such as rage and fear, and thus permits the body to adjust itself to meet the new situation.

The Parasympathetic System. An important characteristic of the parasympathetic division of the autonomic nervous system is that the ganglia, or cell bodies out of which the nerves arise, lie close to the organs which they activate. In some cases, as with the heart and stomach, they lie wholly inside. These organs, as can be seen in Figure 1, are situated in many parts of the body.

The nerves of the cranial division supply motor impulses to the radial muscles which dilate the pupils of the eyes. They control the secretion of the salivary glands, and the actions of the mucous membrane of the mouth. They also furnish inhibitory fibers to the heart, for the purpose of slowing its action, and motor fibers to the glands and the musculature of the gastrointestinal tract, which set in motion and control the process of digestion.

The sacral division, on the other hand, primarily controls the emptying organs, such as the bladder, the colon, and the rectum, as well as the dilation of the external generative organs. In every case, however, the nerve fibers which extend from any one ganglion are short and activate a limited area only. By this arrangement the central nervous system can exert influences on single organs at a time, without influencing others. This selective character sharply distinguishes the parasympathetic from the sympathetic system.

The importance of the parasympathetic nervous system to the individual organism is that it plays a large part in permitting the body to maintain its cycle of normal daily activities in a state of equilibrium. The parasympathetic stabilizes the internal activities of the organism against the necessary changes produced by the process of taking food into the body and transforming this food into energy. It shields the retina from strong light, by contracting the pupil of the eye. It enables the heart muscles to secure longer rest periods than they would otherwise have, by slowing down the heart rate. It controls the flow of saliva and of gastric juices, and the muscular contractions of the alimentary canal; these are the essential elements in the process of digesting and assimilating food. Finally, through the sacral division, it motivates the elimination of waste products from the body.

The Sympathetic System. The sympathetic division of the autonomic nervous system, in contrast to the parasympathetic, is so arranged that it produces general, or diffuse, discharges of nervous impulses. The sympathetic nerve fibers constrict the small blood vessels of the abdominal organs,

skin, and other parts of the body; they accelerate the heart and control the secretion of the sweat glands. In contrast to the stabilizing function of the parasympathetic, they inhibit the action of the smooth muscles of the intestinal tract, thus stopping the process of digestion.

Some of the sympathetic nerve fibers control the smooth muscles of the scalp, which cause hair to stand erect; others dilate the pupils of the eyes and make the eyeball project forward in its socket. The fibers which control the liver cause it to release sugar into the blood, while those connected with the spleen produce a contraction of this organ and the release of red corpuscles into the bloodstream. The most important action of all is reserved for the fibers which run to the medullary portion of the adrenal glands, situated near the kidneys; these fibers activate a secretion of adrenalin into the bloodstream.

The operation of the sympathetic nervous system, as described above, is greatly reinforced by the action of adrenalin. Adrenalin, in fact, has exactly the same effect on the various organs of the body as do the impulses of the sympathetic system; it contracts the muscles which the sympathetic nerves cause to contract, and relaxes those which they cause to relax. The fact that adrenalin does not activate the sweat glands, while the sympathetic fibers do, forms the only exception to this rule.

To reinforce the impulses of the sympathetic system is not the only purpose of adrenalin; it achieves a number of other important results of value in time of crises. For example, it improves the ability of fatigued muscles to contract, both by lowering their response threshold,[2] that is, the level of intensity needed to activate the muscle, and by increasing the magnitude of the response obtained. The presence of adrenalin in the bloodstream, furthermore, causes the blood to coagulate more rapidly in the case of injury than it otherwise would; it also permits a more rapid metabolism of blood sugar, the principal source of muscular energy, which is released from the liver by the stimulation of both the sympathetic system and adrenalin.

The utility of these changes in the body in response to the excitation of the sympathetic system and to adrenalin must now be made clear. By means of these responses, the body is not only made ready to act, but it is also prepared to meet the consequences of heightened activity. The physiological changes which take place may be summarized as follows. The blood vessels in the skin and the viscera being contracted, the blood pressure

[2] The term "threshold" may be roughly defined as a limit below which a response does not occur. If a piano key is pushed down very lightly and slowly, no note will be sounded. The force exerted was therefore below the threshold.

rises; this forces a greater blood supply into the skeletal muscles, the fatigue threshold of which is lowered. Sugar stored in the liver is released into the bloodstream, so that it may be converted into muscular energy. The red corpuscles of the blood are meanwhile increased in number by action on the spleen, which in consequence increases the oxygen supply. At the same time, the respiration rate increases, speeding up the whole metabolic process, and the blood itself is made ready for rapid coagulation should it be exposed to the air. The heart rate, too, is increased, and this speeds up the circulation of the blood, so that adrenalin and blood sugar are hurried to the muscles, and waste products hurried away. The intestines and stomach are contracted, and the digestive process stopped; the sweat glands are stimulated, and the body hair raised.

These far-reaching bodily changes which take place when the sympathetic system begins to function enable the organism to perform tasks which require tremendous effort, and to maintain a level of high activity in situations of grave danger which the unstimulated organism could not withstand. The survival value of the ability to make these changes is self-evident.

The Contrasting Activities of the Sympathetic and Parasympathetic Systems. As a general rule, which we have just seen illustrated by the intestinal tract, when both the sympathetic and parasympathetic systems have nerve fibers in any organ, the activities of these systems in that organ are opposed to each other. For example, the cranial division of the parasympathetic slows the heart, while the sympathetic dilates it. The cranial contracts the iris, the sympathetic dilates it. The sacral division contracts the lower portion of the large intestine, the sympathetic relaxes it. The sacral relaxes the bladder, and the sympathetic contracts it.

Cannon interprets these phenomena as follows:

> The cranial autonomic, as already shown, is concerned with a quiet service in building up reserve and fortifying the body against times of stress. Accompanying these functions are the relatively mild pleasures of sight and taste and smell of food. The possibility of the existence of these gentle delights of eating and drinking and also of their physiological consequences is instantly abolished in the presence of emotions that activate the bodily system. The secretion of saliva, gastric juice, pancreatic juice, and bile is stopped, and emotions of the stomach and intestines cease at once, both in man and the lower animals, whenever pain, fear, rage, or other strong excitement is present in the organism.[3]

[3] Cannon, W. B., *Bodily Changes in Fear, Hunger, Pain, and Rage,* Appleton-Century Company, New York, 1936, p. 396.

The cranial division of the parasympathetic is not alone in its opposition to the sympathetic; this is true in certain respects of the sacral division as well. For example, the sacral nerves which control the emptying of the bladder and colon are inhibited by a mild sympathetic activity. A person who is mildly frightened may have difficulty in urinating and in emptying his bowels. However, in cases of extreme excitement, such as great fear, the sympathetic division may bring about a marked activity of these organs; the same person who has had difficulty in the first case will, in a state of terror, involuntarily void them.

A somewhat different situation exists in the case of the external sex organs. The sacral nerves stimulate these organs, and thus permit sexual intercourse. This can only occur, however, when the sympathetic is quiet; an excitation of the sympathetic will prevent or terminate sexual activity. On the other hand, once the sexual act has proceeded through its normal cycle and reached the peak of sexual excitement, the sympathetic system is called into action, discharging nervous impulses throughout the body, and terminating the effect of the sacral system on the external organs by contracting the blood vessels.

In brief, the daily activities of the organism, such as the building up of the body and the elimination of waste, or in other words, the maintenance of the metabolic balance of the body, are controlled by the cranial and sacral divisions of the autonomic nervous system. The bodily processes by which this balance is maintained provide us with what we subjectively feel to be pleasant and agreeable experiences. But, when the bodily system is upset by an injury, by a sudden loss of balance, or by a situation in which sudden action is needed to maintain or to restore the balance of the system, the sympathetic division is brought quickly into action, and the organism experiences sensations which we are accustomed to consider uncomfortable or unpleasant.

III. THE CENTRAL NERVOUS SYSTEM: THE HYPOTHALAMUS, THE CORTEX, AND EMOTION

As we have previously stated, the nervous system may be divided into three parts, the central, somatic, and autonomic. We have already considered the workings of the autonomic in some detail, since it is intimately concerned with emotions. The somatic has received less attention, since its activities in operating the muscles of the legs, arms, and other parts of the body are comparatively well known.

These two systems are coordinated by the central nervous system, i.e., the brain and spinal cord. In the rest of this chapter, and in the chapter

which follows, we shall consider the physiological processes by which this coordination is accomplished. In following the description of these processes, the reader is advised to look at Figure 2, in which the anatomy of the brain is schematically represented.

The Hypothalamus. The first part of the central nervous system which we shall consider is the hypothalamus, a phylogenetically ancient part of

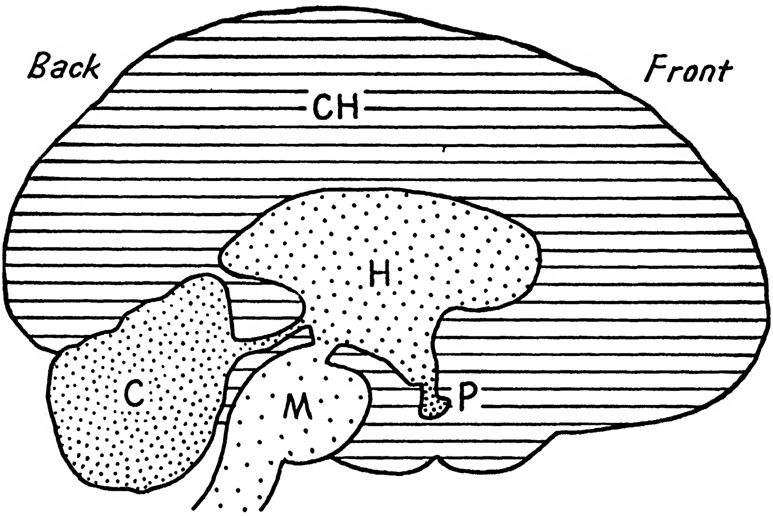


Fig. 2. MEDIAN SECTION OF THE BRAIN

CH Cerebral hemispheres (cortex)
H Hypothalamic region
P Pituitary
C Cerebellum
M Medulla

the brain situated directly under the cerebral hemispheres,[4] which receives nervous impulses from all somatic and visceral areas, and which sends out impulses to the pituitary gland and to the autonomic nervous system. In it is to be found the major control of the autonomic system, a control which it shares to a lesser degree with the cerebral cortex.

The Hypothalamus and the Pituitary. The association between the hypothalamus and the pituitary gland, the operation of which it apparently

[4] The cerebral hemispheres, or cortex, contain the so-called "gray matter" of the brain.

controls, is a close one. As is well known, the pituitary is the master gland of the whole endocrine system, and produces many important hormones which control the activities of the other endocrines. In fact, the pituitary plays a part in the endocrine system comparable to the control which the hypothalamus exerts over the autonomic nervous system. Present evidence seems, furthermore, to indicate that the endocrine system must be regarded as a realm which is tributary to the autonomic system, just as the pituitary is tributary to the hypothalamus. Although this has not yet been completely established, the close propinquity of the two structures, their common embryonic derivation, and the fact that the nerve fibers which activate the pituitary rise in the hypothalamus, all indicate the probability of this interpretation.

The Hypothalamus and the Cortex. The hypothalamus, therefore, must be regarded not only as one of the two great clearing houses for nervous impulses (the cerebral cortex is the other), but also as the principal regulator and chief stabilizing agent in the maintenance of bodily equilibrium. All impulses coming into the central nervous system pass through the hypothalamus before entering the cortical area. In many cases where the stimuli are of an emergency nature, the hypothalamus acts directly, activating the autonomic before any messages are relayed to the cortex. The way in which the hypothalamus operates and the kind of relationship which it has with the cortex are matters of fundamental importance in the study of human behavior.

The Hypothalamus and Emotion. As early as 1822, the relationship between the hypothalamus and emotional activity was suspected, on the following evidence. When lesions which interrupt the motor paths from the cortex occur in the brain as a result of injuries, tumors, or infections, the body becomes partly or wholly paralyzed, but yet, under such conditions, the patient suffers no apparent loss of his capacity for emotional expression. In fact, when such lesions occur, the patient laughs or weeps with extreme ease in response to what would ordinarily be regarded as very minor situations. On the other hand, when the lesions occur in the region of the hypothalamus, the emotional activities of the patient are markedly impaired. The observation of these contrasting phenomena suggested to early investigators that the control of emotion might be located in a nervous center separate from the cortex, and that, under normal conditions, the cortex kept the activity of this center under control.

Evidence of this kind, derived from the study of the effect of lesions on the central nervous system, has since been supported by the evidence of the effect of anaesthesia on the organism. When a patient is given ether

or chloroform, the first effect is that the activity of the cortex is inhibited, and he begins to lose consciousness. Once this initial stage has been passed, a period of marked excitement ordinarily follows. The patient, who is now on the operating table, offers a remarkable display of emotion. He laughs uproariously, groans, weeps, screams with rage, and tries to leap about, often attempting also to strike the nurses and doctors. During this period of excitement, before the onset of deep anaesthesia in which reflex activity becomes completely inhibited, attendants may have to hold the patient to keep him from injuring himself and others. In obstetrical work in which barbiturates such as sodium amytal or pentabarbital are used, special nurses, selected for their sturdy physiques, are trained to handle excited patients.

During this period of excitement, while these emotional fireworks are going on, the patient is completely unconscious. A surgeon can, in case of emergency, perform a serious operation while the patient is in this state, without waiting for deep anaesthesia to set in, and the patient will be totally unaware of what is happening.

In daily life, similar effects are observed in persons under the influence of alcohol, which acts in the same way as the drugs just mentioned, inhibiting the cortex and releasing the hypothalamus from its cortical control, with the result that very slight stimuli will produce angry outbursts or tearful confessions which the intoxicated person would never, under normal conditions, permit himself to disclose.

The evidence given above not only serves to indicate the kind of relationship which exists between the cortex and the hypothalamus, but also shows that, in the adult human being, the full and unrestrained activation of the autonomic nervous system occurs but infrequently. Only in situations of grave danger, in sudden shocks, and in other events in which the stimuli are very intense, does the hypothalamus normally activate the autonomic system and its associated organs directly. The control which the cortex exerts over the hypothalamus is, however, separately acquired by each individual during the course of his lifetime; as we grow up we learn to suppress or to inhibit our expressions of emotion. In the following chapter we shall consider how this learning process conditions our emotions and enables us to adjust ourselves, with varying degrees of satisfaction, to the human environment in which we live.

SUMMARY

The human organism is constantly making automatic adjustments to changes in its external environment. By means of these adjustments the body is able to maintain a state of equilibrium; and is thus able to keep

working. For example, the temperature must be relatively constant if the blood is to circulate; and the amount of light that enters through the pupil of the eye must not be too great if the person is to see.

The equilibrium of the human organism is maintained through the operation of the nervous system, which activates those organs which keep the temperature constant, the blood flowing at a steady rate, the iris of the eye in adjustment to the amount of light, etc. The nervous system is divided into three parts: (1) the Central Nervous System, which is a clearing-house for nervous impulses, and consists of the spinal cord and brain; (2) the Somatic Nervous System, which operates the muscles of the legs, arms, jaw, etc.; and (3) the Autonomic Nervous System, which is the part directly concerned with the voluntary and involuntary activities of the viscera, and thus with "emotions," which may be described as automatic reactions to disturbances of equilibrium.

The Autonomic is divided into the Sympathetic and Parasympathetic. The Parasympathetic is concerned with maintaining equilibrium in ordinary activities such as digestion and elimination, which may be regarded as relations between the organism and its environment. The sympathetic is concerned with arousing the organism to action, and with stirring up emotions, such as fear and rage, which permit the body to adjust itself to meet crises in external relations. The sympathetic thus temporarily upsets or changes the equilibrium of the organism. In this it is aided by the secretion of the adrenal glands, which have the same effect on the organism.

The Central Nervous System coordinates the activities of the autonomic and somatic. The brain, which is the major part of the Central Nervous System, includes the hypothalamus and the cortex. These two act as a clearing-house for nervous impulses. An impulse from one part of the body goes to the hypothalamus, where other nerves are activated in response to the stimulus. Ordinarily the hypothalamus is subject to the control of the cortex, since most impulses are routed to the cortex and back before a response occurs. However, when the stimuli are very intense, or when the cortex is incapacitated by injury or anaesthetics, the hypothalamus acts directly without the cortex.

The control which the cortex exerts over the hypothalamus is separately acquired by each individual during his lifetime, by the process of *conditioning,* or learning. This is how we are able to control our emotions and thus to adjust ourselves to each other.

CHAPTER 3

Conditioning and Human Relations

INTRODUCTION

The subject of conditioning, as the process of learning is called in scientific language, is commonly associated with the name of Ivan Pavlov, (1849-1936), a Russian physiologist. Although many of the results which Pavlov obtained had already been established in less precise form by earlier investigators, Pavlov was the first to study the physiological mechanisms by which learning is accomplished. These mechanisms are generally classified under a single term, coined by Pavlov, "the conditioned reflex." Even though many complex activities, such as emotions, which we have described in the last chapter, are not strictly reflexes in his sense, the modern concept of a conditioned response, which has been derived from Pavlov's work, forms the basis of our present understanding of the adjustments of organisms to their environments.

I. THE CONDITIONED REFLEX

The way in which conditioning operates can be initially illustrated by Pavlov's work on the salivary reflex. The first time that a dog (or any other mammal) is given something to eat or drink that it has never tasted before, no reaction takes place until the substance has entered the animal's mouth.[1] When this happens the salivary glands begin to secrete saliva, in response to the stimulation of the taste-buds at contact with the food. This secretion of saliva is a reflex activity; it occurs automatically, and the mechanism by which it operates is found in the animal at birth.

Now if, as one might expect, the animal is given milk as his first food, he gradually begins to associate certain other sense impressions of the milk with its taste. These sense impressions, such as the smell and the color of the milk, are stimuli which the animal perceives immediately before the act of drinking the milk starts off the secretion of the salivary glands, which,

[1] Exceptions, of course, occur when the new food or drink resembles one which the animal has already learned to recognize.

as we have pointed out in Chapter 2, are under the control of the autonomic nervous system, and hence of the hypothalamus.

After this context of events (the presentation of the milk, the perception of its color, its smell, and its taste, and the accompanying activity of the salivary glands) has been repeated a number of times, the animal begins to salivate when he either sees or smells the milk, before the substance actually enters his mouth. This situation, in which a secondary stimulus, like the color or smell of the milk, starts a reflex activity such as salivation, is what Pavlov describes by the term "conditioned reflex." It must be emphasized that the stimulus must be presented to the animal *before* the reflex itself is set in operation, otherwise the sight or smell of the milk will not cause him to salivate; in other words, there will be no conditioned reflex.

Although the reflex activity just described (salivation) is under the control of the hypothalamus, the linkages which make it a conditioned reflex are set up in the cortex. If the hypothalamus alone were concerned, no differentiation of stimuli could be made; the dog's mouth would salivate automatically whenever its taste-buds were touched by any object whatever. In the example outlined above, however, the animal tastes the milk, and the taste discrimination is made in the parietal lobe of the cortex, where the sensations of touch and warmth are located. The visual discrimination, on the other hand, occurs in the occipital lobe, and the association between the visual stimulus and the sensation of taste proceeds through an automatic linkage[2] between these two cortical areas.

So far, we have limited our attention to the way in which a conditioned reflex is formed. The same process is concerned with its maintenance. In other words, the *repetition* of a stimulating situation is as essential to the continued existence of a conditioned reflex as to its establishment. Very often, in training a dog, the stimulus must be repeated many times before the habit (a synonym for conditioned reflex) is learned; a well-trained dog is one which performs the habitual action whenever the stimulus (such as a gesture or command) is repeated. Such a dog, people often say, "obeys automatically."

Just as repetition is necessary to establish and maintain a conditioned reflex, so this reflex may disappear if the repetition is not kept up. Let us suppose, for example, that the dog is fully conditioned to salivate at the sight of milk. The milk is then set before the dog once more, but this time the dog is not allowed to taste it, and the milk is soon taken away. After this new sequence of events has been repeated a number of times, the dog will lose his capacity to respond to the habitual stimulus, i.e., the sight of milk.

[2] These linkages are physico-chemical processes.

If the original conditioned reflex is to be maintained, the *entire* sequence of stimulation, including the activation of the basic reflex itself, must be gone through; this process of repetition in entirety is called the *reinforcement* of the conditioned reflex. In other words, the dog must not only see the milk and salivate, but he must also be allowed to taste it now and then, or the whole process will become extinct.

The speed with which a learned habit, or conditioned reflex, of this sort may be lost depends upon two quantitative factors: (a) the number of times that the original context has been repeated, and (b) the number of times that the milk is presented and withdrawn untasted. These factors may be measured by the simple process of counting; the second will be found to bear a definite relation to the first one.

II. THE EXTENSION OF LINKAGES

During the process of learning, the simple conditioned reflexes which are first established become elaborated by the linkage of other stimuli to the original ones. For example, if a dog, having been brought up on a milk diet, has never tasted meat, the sight of meat will not produce salivation. Once, however, he has tasted it, he is able to extend the context of the original reflex (sight of food = salivation) to the meat, so that he will now salivate in response to more than one stimulus.

However, as the dog experiments with different substances, he discovers which are edible and which are inedible by tasting them, and those substances which do not respond to his sense of taste [3] will not be linked to the sight of food = salivation reflex; that is, he will not salivate when he sees them. In this way the dog is able to build up a series of discriminations, all of which are organized around this basic reflex.

In his studies of the conditioned reflex, Pavlov confined his attention almost entirely to the reflex of salivation; he preferred this reflex because he was able to count the drops of saliva which fell from the dog's mouth upon the presentation of the stimulus, and could thus obtain a numerical estimate of the degree of response to any given stimulus. His most famous experiments were those in which he substituted other stimuli for those derived from the properties of the food. For example, by ringing a bell each time that meat was shown to the dog, he was able, after a number of repetitions, to make the dog salivate at the sound of the bell, even when no meat was in sight.

The simple observation that a dog can be trained to drool at the mouth

[3] I.e., do not activate the taste-buds and thus produce a secretion of the salivary glands through the parasympathetic system.

when the dinner bell rings need not have been discovered in the physiologist's laboratory: what is important here is that Pavlov was able to show the steps in the process by which the dog learned this habit. A dog could be taught not only to respond to such simple stimuli as the sound of a bell, but also to make very fine discriminations. One of Pavlov's standard procedures was to condition a dog to the beat of a metronome, and a dog that learned to salivate when the metronome was beating 104 times a minute would not respond to a beat of 100.

By painstaking and exhaustive experiments, Pavlov and his followers showed that almost any stimulus could be associated with the fundamental reflex, whichever one of the sensory receptors, such as hearing, sight, taste, and smell, was involved. A flash of light, the pitch of a musical tone, the dimensions of an ellipse drawn on a blackboard, the act of touching a particular part of an animal's anatomy, as well as the facial expression of the experimenter, could all be used in establishing a conditioned reflex. Many of the more subtle discriminations involved long periods of conditioning, but as long as the stimulus selected to activate the reflex was presented a short time before or almost coincidentally with the known stimulus, and as long as care was taken to reinforce the stimulus by activating the reflex, as, for example, by feeding the dog, conditioned reflexes of the type desired by the experimenter could be built up. A dog could even be taught to wag his tail and show signs of joy when he was burned.

The discovery of the mechanism of the conditioned reflex is of great significance to us in our effort to understand human as well as animal behavior. By means of it we are able to observe the mechanism by which both animals and men discriminate between situations containing different stimuli, and learn to respond to them in a differential manner.

Differences in the Conditioning of Individuals. The environments in which we live differ enormously from one another, and furthermore, within each environment there are great variations in content from hour to hour and day to day. These differences between and within our environments provide us with a great variety of materials for conditioning. It must be remembered that the unconditioned organism, being almost entirely under the control of the hypothalamus, makes gross and undifferentiated responses to all sensations. However, as the conditioning process gets under way, the organism learns to discriminate between situations and to respond to each in kind; thus different organisms reflect, through this process, differences in the environments to which they have been subjected. It is the conditioning process, therefore, which brings about most of the profound individual

differences in our behavior, in our likes and dislikes, and in our habits of thought.

It is a commonplace of knowledge that the diets of different peoples vary widely. We learn by conditioning to like the foods which are available to us, and we dislike those foods which other people eat which vary in appearance too widely from those of our own experience. The Australian Black, for example, is fond of grubs and insects, which few people in this country could be persuaded to eat.

In the same way, we learn different types of behavior in our habits of speech and gesture, and in comparing our customs with those of other peoples we find that the conditioning process sometimes produces almost incredible variations. When we meet people whom we haven't seen for some time, we shake their hands and contort our faces in expressions of joy. We may even laugh delightedly and pump the other person's hand. When two Andaman Islanders meet, however, they sit in each other's lap and weep unrestrainedly. In the Andaman Islands weeping is considered a sign of joy.

Symbols. In this book, which deals with the activities of people throughout the world, we shall find that there is an enormous variation in the stimuli which produce responses in individuals. When stimuli are associated with a basic conditioned reflex, we shall call them *symbols* of the reflex activity. Thus when a dog is conditioned to salivate at the sound of a bell, we call the sound of the bell the *symbol* which stands for the conditioned reflex (sight of food = salivation). Words are, of course, the commonest symbols with which we have to deal in studying human behavior, but tangible objects like flags and crosses and dunce caps and thrones may also become symbols of specific activities. Later on, we shall consider at length the process of symbolization in human behavior, and its importance.

The Automatic Character of Emotional Responses. Although Pavlov concerned himself primarily with the salivary reflex, the importance of his work lies in the fact that it provides us with an understanding of how our emotions, like those of the dog, become conditioned. The response of the autonomic nervous system to environmental change is an automatic one, and it is as much a reflex activity as sneezing or coughing or sucking or salivating.

In this connection, speaking particularly of rage, Cannon says:

. . . its occurrence in the early months of even so highly developed an organization as the human infant indicates that its neural pattern, like that of the reflexes mentioned above, is congenitally inwrought in the central nervous apparatus.

Second, as in the reflexes, it is a prompt response to an appropriate stimulus. Again it is a constant and uniform response—so much is this so, indeed, that there is no mistaking its character, whether it be manifested by the diverse races of man or by the lower animals. It is like the reflexes also, in being a permanent mode of reaction; throughout life the characteristic display of the rage response may be suddenly evoked in all its elaborateness. Further it is a response to a fairly definite stimulus—an inner stimulus which arises when there is a hampering or checking of motion or an opposition to one or another primary impluse. Finally the rage response is like the simple reflexes in being useful.[4]

The evidence further indicates that the other major forms of emotion, fear, and the less precisely defined, sex, sorrow, and joy, are similarly of this simple and fundamental character.

III. THE DEVELOPMENT OF CONDITIONING IN THE HUMAN INFANT

In a newborn child emotional responses, as Cannon points out, occur in a characteristic all-or-none pattern. The extensive changes in the autonomic nervous system, which we call rage or fear, joy or love, are set in motion by stimuli of slight intensity—stimuli which in the adult would produce very minor changes. The baby, in fact, is much like the adult under anaesthetic; in both cases the hypothalamus is not inhibited by the cortex; in the case of the baby, because the cortex is as yet unelaborated, and in that of the anaesthetized adult, because cortical activity is inhibited. The process of conditioning, therefore, involves the development of cortical patterns which control and inhibit the autonomic discharges, and we must now consider what the conditioning process is which brings about these changes, and how our emotions become conditioned to the environment in which we live.

The stimuli which accompany changes in the environment, and which activate the autonomic system, come to a very large extent from other people. From the moment of birth onward, the child is acted on by other individuals, and he learns to adjust his activities to theirs. For example, he is usually fed by his mother, and the act of taking food from her breast conditions him to a context of happenings in which the actions of his mother are associated with food. Ordinarily, when older persons are paying no attention to the child, he lies in a relatively constant environment; hence, the only sudden changes which bring about emotional responses in him are usually those produced by the actions of people. It is, therefore, on account

[4] Cannon, W. B., "Neural Organization for Emotional Expression," in *Feelings and Emotions,* Clark University Press, Worcester, Mass., 1928, pp. 257-269.

of the helplessness of the human infant that our conditioned reflexes, which are largely formed in infancy, are built up primarily out of the activities of people, rather than out of the context of the non-human elements in the child's environment. It is only in later life, after he has learned to adapt himself to the outside environment, in order to provide food and other material needs for himself and his family, that the individual's relations with the material world about him become really important. Even then, as we shall see later, he conducts most of his relations with this world in terms of his relations with other people.

Let us return to the case of the newborn child. In the daily routine which the child undergoes, he gradually learns to interact with his parents. When his mother picks him up to feed him, to adjust his clothing, or to dandle him on her knee, the child adjusts his actions to follow those of his mother. While in the newborn child these actions are unspecific, as he grows older he learns to respond in a number of ways to the varied stimuli of his mother's and father's actions.

If the child is uncomfortable or hungry, the environmental change which disturbs his system and throws him into a rage produces, as part of his organic response, a cry, which is followed shortly by the appearance of his mother, who picks him up and feeds him or adjusts his clothing. By this means the child very soon learns that his cries will bring some adult to look after him. Soon after this he usually learns that, if no pain or serious discomfort affects him, his mother will not pick him up, and hence he ceases to respond to all unpleasant stimuli by crying.

Almost from the time of his birth, therefore, the child is conditioned to interact with his parents, and he soon learns to discriminate between those stimuli which can be counted on to produce the mother, and those which cannot. As a result the all-or-none character of his emotional response begins to be modified; he ceases to fly into a rage at every discomfort.

Again, almost from birth, the child becomes conditioned to a regular schedule of interaction with his parents, organized around the repetitive sequence of events involved in eating and sleeping. Since the mother habitually wakes the child and feeds him at regular hours, the child begins to awaken at these times of his own accord and to wait expectantly for his mother's appearance.

With less regularity, as a rule, other relatives, including the child's father, brothers, and sisters, visit him and act in different ways, talking to the child, fondling, poking, tickling, or slapping him, and the child learns to associate these special forms of activity, and his responses to them, with

specific persons. If, for example, a person who has previously slapped him comes into the room, the child may cry. By his interaction with different persons, the child thus learns to discriminaté between different situations.

In his daily life the child interacts time after time with specific individuals, such as his mother and other relatives, in specific situations. Out of the repetition of these situations the child automatically selects the constant elements, that is, those that have occurred in a relatively large number of them, and these elements become, to the child, the symbols of the relationship between himself and the persons concerned. A child may, for example, associate his father with a watch, and his grandfather with a cigar. Such symbols become linked to the basic reflex activity of the child, and form part of the conditioned reflexes with which they are associated.

Let us suppose, as a further example of this, that the child has learned to drink his milk from a cup held by his mother. If this has been going on for some time, the child may refuse to take his milk if anyone else holds the cup. Let us further suppose that the mother does not wear the same dress every time she feeds the child, and that she feeds him out of cups of different appearance. The dress, the cup, and other elements of the situation which are not constant do not become symbols, and fail to elicit emotional responses from the child either by their presence or their absence. If, however, as frequently happens, the child is fed each time from the same cup, he may refuse his food if the cup is broken and a new one of different design substituted. In such a case both the mother and the cup have become symbols.

Sooner or later,. either deliberately or by chance, the child's habit of taking his food from his mother becomes extinguished, and he learns, by dint of going hungry, to become relatively indifferent as to who feeds him. The steps by which this indifference is produced usually have much to do with the changing adjustments of the child to his mother.

This adjustment must not, of course, be regarded as a single reflex; it is actually a complex of activity which is made up of a chain, or pattern, of conditioned reflexes. Not only does the act of eating stimulate the taste-buds in the mouth, producing salivation, but it also forms the first step in a series of adjustments within the organism which last for several hours. During this time, the parasympathetic division of the autonomic nervous system maintains the equilibrium of the body while the process of digestion is going on. During the preliminary stages of this process, that is, while the child is eating, the child is adjusting himself to the activities of the people around him. If the activities of these persons continue with the expected regularity, as established by previous experiences, no disturbance

will take place to upset the child's digestive process. If, however, a sudden change takes place in the actions of these persons, the child is stimulated by these changes, and the consequent need of adjustment activates his sympathetic nervous system, stopping his digestive process, and causing unpleasant feelings in his body. If such disturbances tend to be repeated, the relationships between the child and the persons with whom he is interacting at mealtimes, including his adjustment with his mother, begin to change.

If the child's habit of being fed by his mother has been strongly established, the substitution of a new person to perform this act may cause serious disturbances. If, however, the relation with the new person is constantly maintained, that is, if the new person continues to feed the child, the child learns to adjust himself to this new situation. If, on the other hand, the new relation is not maintained, or if extensive changes in interaction often take place, as through attempts to make the child take milk from a different person by pleading and cajoling, the child's sympathetic nervous system is continually stimulated and his physiological processes may be gradually adjusted to a level at which its emotional responses are relatively uninhibited. In other words, disturbances in the conditioning process produce what we call an emotional, or spoiled, child.

Conditioning, and the Adjustment of the Individual to Others. A knowledge of the mechanical character of conditioning is important to us in our present task, since it permits us to observe and to interpret, (a) the gradual modification of the already established reflex patterns of the individual, and (b) the molding of the reflex activities inherent in the newborn child which takes place continuously in the life of each individual. These continual changes in conditioning are brought about by the necessity of the individual to adjust his actions to those of others. In short, each person has to learn how to interact with others.

One step in this process is the unconscious adjustment by which the child is taught not to interrupt an adult; the child's attempts to break into the conversation produce no response, and the adult continues to talk without paying any attention to the interruption. Through experiences of this sort, the child learns to wait until the other person has stopped talking before he begins to speak. This process of learning to synchronize his actions with those of another, that is to say, to wait until the other person has stopped talking, is reinforced by deliberate training on the part of the adult.

Training is merely a process of making the child repeat actions in a certain order until the desired response becomes automatic. In our own

society, children are taught manners and deportment, that is, the rules which specify the way in which interaction with others should be carried out. A common shortcut in this training process is to reinforce the desired reflex by linking it to already established conditioned reflexes. A common example, derived from the experience of almost everyone, is the practice of giving the child food, such as candy, when he has done something well, and of punishing him when he has done it badly, that is, when he has deviated from the desired routine of behavior.

In well-regulated families in our own society children are taught not to speak until spoken to, to rise when their elders enter the room, not to interrupt, to reply quickly when spoken to, and other useful habits. The reinforcement of these rules of behavior builds up habitual patterns by which individuals adjust to one another. These habits insure orderly relations between individuals and thus minimize the disturbances which rise in the event of unexpected or irregular interactions. If the child does not learn regular patterns of interaction, his lack of adjustment, as made evident by continual interruptions and failures to respond, will produce marked disturbances in the autonomic nervous systems of everyone around him.

The principal result of the conditioning process is to modify the all-or-none reflex character of the emotional response. As the individual learns to differentiate between more and more situations, he builds up an increasing number of cortical connections which inhibit the full-fledged expression of emotion, and which permit his organism to respond within the limits of an orderly pattern. In this way the emergency character of many stimuli is lost, as the organism learns to recognize and to react to more and more of them. Yet when disturbances do occur to which the individual is not conditioned, the hypothalamus takes control, short-circuiting the cortex, and the characteristic reactions of uncontrolled emotion result.

An important point that should be remembered here is that the process of inhibition does not shut off emotional response completely; it actually lowers it and limits its intensity. Whenever, therefore, we respond to stimuli of any kind, some modification always occurs, even though little immediate effect is noted. Such minor stimuli, however, have a cumulative effect, and they may combine with each other eventually to build up a marked activation of the autonomic nervous system.

Since a great part of our lives is spent in adjusting to others, a knowledge of the mechanics of adjustment is necessary if we are to understand human relations. It should be clear from what has gone before that the response of one individual to the action of another not only modifies his own actions, but, as part of the process of modification, sets up changes

within his own organism which we call emotions. We must now consider, in a little more detail, how differences in human relations consequent upon this process of adjustment are developed, and how they may be described objectively.

IV. INTERACTION: THE RELATIONS OF INDIVIDUALS

Origins of Action and Responses. When two individuals meet, one of them performs some action, and the other responds. When, for example, a well-brought-up child, who has been trained not to speak until spoken to, meets an adult, the speech of the adult which precedes the child's reply is called an *origin of action*. The child's reply is the *response*. If a number of meetings take place between these two individuals, we can count up the number of origins of action and responses, to see whether, in fact as well as in theory, the child habitually fails to originate action to the adult. By this means we may also observe whether or not, as time goes on, the child's pattern of interaction changes progressively.

The observation of the order in which people act is a simple operation, and will be found very useful in describing the relations of individuals in groups. Its importance lies in the fact that once two individuals have been conditioned to maintain an order in which one of them habitually originates action to the other, we are dealing with the rudiments of the phenomenon known as leadership.

In the lower animals and among children, many studies have been made of the order of action. It has been shown, for example, that among hens a so-called "peck right" is established when one hen pecks another, and the pecked one makes no attempt to peck back.[5] The peck right may be established after a fight, in which the winner becomes the pecker, but once it has been established, the two hens retain their relative positions in future interactions.

Among pigeons, the peck right is not as stereotyped nor as invariable as among hens, since one bird does not immediately establish dominance over another. Their origin-response relation, therefore, is not really a peck right, but a *peck ratio*. This peck ratio varies in a constant progression with the number of times that the birds encounter each other; leadership is established by a gradual conditioning process. Among other animals, from fish to monkeys and apes, habitual sequences of origins and responses have also been reported.

Extensive studies have, furthermore, been made of children playing to-

[5] Allee, W. C., *The Social Life of Animals*, New York, 1938; Crawford, M. P., "The Social Psychology of Vertebrates," *Psychological Bulletin*, Vol. 36, No. 6, 1939.

gether, including a study of the Dionne quintuplets. These investigations have shown that the ratio of origins to responses in the relations of children to one another remains constant over definite periods of time. Even among adults, the same thing occurs; in order to observe this, one need only watch the interaction between the foreman of a factory and a worker, an employer and his valet, a judge and a witness, or any of the many other relationships in which the order of action is habitual, constant, and prescribed.

Set Events. The same kind of habitual order may also be observed when more than two persons are involved. Here perhaps we find the most clearcut instances of interaction, in which the order of action repeats itself with a constant ratio. When, for example, we watch a regiment drilling, we see hundreds of men responding in unison to the orders (i.e., the origins of action) of an officer. In a court room, the judge commands the assembly to come to order; in a church, the priest, or minister, leads the congregation in prayer. As we shall see later on, these group or set[6] events, in which one person habitually originates action to a number of others, are of great importance in building up the relations of individuals in institutions.

Not only are set events a matter of order of response, they are even more drastically a matter of timing. The successful leader must not only know how long to say something, he must also know when to be silent and for how long, if he is to obtain a maximum response. No one has more clearly recognized the importance of timing than Mark Twain, and his comments on this subject are reproduced here because of their clarity and their keenness of observation.

When a man is reading from a book on the platform, he soon realizes that there is one powerful gun in his battery of artifice that he can't work with an effect proportionate to its caliber: that is the *pause*—that impressive silence, that geometrically progressive silence which often achieves a desired effect when no combination of words, however felicitous, could accomplish it. The pause is not of much use to the man who is reading from a book because he cannot know what the exact length of it ought to be; he is not the one to determine the measurement—the audience must do that for him. He must perceive by their faces when the pause has reached the proper length, but his eyes are not on the faces, they are on the book; therefore he must determine the proper length of the pause by guess; he cannot guess with exactness and nothing but exactness, absolute exactness, will answer.

The man who recites without the book has all the advantage; when he comes to an old familiar remark in his tale which he has uttered nightly for a

[6] The term "set" is preferable to "group," for reasons that will be explained in Chapter 12.

hundred nights—a remark preceded or followed by a pause—the faces of the audience tell him when to end the pause. For one audience the pause will be short, for another a little longer, for another a shade longer still; the performer must vary the length of the pause to suit the shades of differences between audiences. These variations of measurement are so slight, so delicate, that they may almost be compared with the shadings achieved by Pratt and Whitney's ingenious machine which measures the five-millionth part of an inch. An audience is that machine's twin; it can measure a pause down to that vanishing fraction.

I used to play with the pause as other children play with a toy. In my recitals when I went reading around the world for the benefit of Mr. Webster's creditors, I had three or four pieces in which the pauses performed an important part, and I used to lengthen them or shorten them according to the requirements of the case, and I got much pleasure out of the pause when it was accurately measured, and a certain discomfort when it wasn't. In the Negro ghost story of "The Golden Arm" one of these pauses occurs just in front of the closing remark. Whenever I got the pause the right length, the remark that followed it was sure of a satisfactorily startling effect, but if the length of the pause was wrong by the five-millionth of an inch, the audience had had time in that infinitesimal fraction of a moment to wake up from its deep concentration in the grisly tale and foresee the climax, and be prepared for it before it burst upon them—and it fell flat.[7]

The Frequency of Interaction. As we have already seen, the order in which individuals learn to act is of great significance in the development of human relations. Another important operation, and one which may be observed just as easily, is the number of times that these interactions take place. As we have seen in our study of the conditioned reflex, the repetition of events is necessary to produce habitual relations. We can, therefore, evaluate differentially the relations which one individual has with a number of other persons by noting the relative frequency with which he interacts with each. Furthermore, we can observe changes in the relations between two persons by recording the times that they meet over a given period, and measuring the length of time that they spend together at each meeting. A relation in which you see a person once a year is not nearly as important as one in which you see a person every day, provided that the length of the meeting and the character of the adjustment within it are in all cases equal.

Frequency of interaction is of physiological importance in maintaining our emotional adjustments within our relations to others because the repetition of events reinforces the effect which interaction sets up in the internal

[7] Twain, Mark, *Mark Twain in Eruption,* edited by Bernard de Voto, Harper and Brothers, New York, 1940, pp. 225-226.

environment of the organism. This effect varies with the nature of the adjustment that takes place within a single meeting; the nature of the adjustment, furthermore, depends on a number of factors, including the ratio of origins to responses, the length of time during which the two persons interact, and the extent to which the two persons have adjusted their interaction rates to each other.

Individual Differences in Interaction Rates. Each individual has an habitual pattern of interaction by which his personality is distinguished. Some persons talk for long periods of time before they at last fall silent, and their periods of action are of great regularity, being repeated over and over again within narrow limits of variation. If a person of this type talks with almost anyone other than a person who is inclined to long silences, the second person will be able to do little more than nod his head. Each time that the second person, under the pressure of his own desire for activity, tries to break in, he is talked down with the ponderous regularity of a steam roller. This style of interaction usually reduces the second person to a state of impotent silence, and, by inhibiting his action rate, it produces an unpleasant emotional response.

If two persons of the first type converse, however, as soon as they have begun to interact they will find that they are continually interrupting each other, cutting off each other's remarks. As they endeavor to adjust their interaction rates to each other's, the effect of the interruptions is to activate their sympathetic nervous systems and thus to start a conflict. As each person tries to dominate the conversation by interrupting the other one and talking him down, the interruptions come more and more quickly, and the periods of silence drop to a minimum. Only if and when one person has been able to outtalk or outact the other consistently during a number of meetings of this sort does the heat of the conflict begin to abate, the periods of action become more evenly spaced and the silences longer.

The degree of adjustment between two individuals may be measured in terms of the amount of synchronization between their actions and silences. When two persons are able to interact, within the normal limits of their interaction rates, in such a way that they do not interrupt each other frequently and that neither fails to respond when the other stops talking, they are well adjusted, and their adjustment stimulates the parasympathetic system pleasantly. In other cases, in which the persons concerned are poorly adjusted, the disturbing effects of interruptions and failures to respond produce changes in the sympathetic nervous system which the physiologists describe as pain, fear, and rage. The intensity of an emotional dis-

turbance so produced, as the physiologist would measure it, depends upon both the frequency and the intensity of the disturbances in interaction.

The relations of every individual to others are, therefore, made up of events which occur with definite frequencies, and which, in each case, exhibit definite degrees of adjustment. Each single event plays its part in determining the equilibrium of the individual, either by helping to stabilize an attained adjustment, or by upsetting one which has already been acquired.

These events condition the basic reflex patterns of the emotions. Under the influence of the habits of action which each person acquires through his adjustment to others, he develops a characteristic emotional and interactional system, which we call his personality.

It must be remembered that these interaction rates, in terms of which individuals adjust themselves to each other, involve all kinds of activities. They include, for example, the rhythmic synchronization which occurs when two persons are sawing wood with a cross-cut saw, or when two partners are dancing. A favorable adjustment of rates is just as important in these activities as it is in conversation. Conversation, however, is the best example to use in illustrating human interaction, since it precedes, accompanies, or follows most, if not all, other actions in which two or more persons are involved.

Interaction and Human Civilization. *Interaction*, as we have seen, may be defined as the reciprocal relationship between two or more human beings or animals. Interaction may take the form of sexual intercourse, of a fight, or of two people chatting together. It may also take the form of two or more persons doing something to, or with, some object in unison: for example, two men hauling on a log to move it out of the forest, or eight men rowing a shell as a racing crew, with the coxswain, the ninth man, the only one who speaks while the race is in progress.

Action can be originated without speech. A male monkey originates action to a female monkey when he attempts to have sexual intercourse with her. A relay racer, finishing his lap, originates to a team member when he hands the latter the stick. A female robin originates to her young when she drops segments of angleworm into their beaks.

Interaction is not the only activity of man. A man who goes out hunting alone and kills a deer interacts with no one; he performs an action in terms of the non-human part of the environment in which he lives. If, however, one man chases a deer down the path, and a second man, lying in wait, shoots the deer, then the two men are interacting in terms of deer hunting.

All animals interact to some degree with other members of their own species. Fish that swim in schools, birds that fly in flocks, build nests and care for their young, have relatively elaborate types of interaction, as do the kinds of mammals that travel in herds. The gregarious insects, such as the ants, spend much more time interacting than they do in acting solo. Such is also the case with man, no matter where he lives or what his type of civilization.

In the life history of every human being, the infant interacts with others almost continuously from the moment of birth onward; until the age of self-support is reached, the human being performs few solitary actions. Even in the adult stage, no human being can live alone indefinitely; cases of complete isolation, such as that of Alexander Selkirk on his island, are rare and usually of brief duration. The whole physical make-up of man, including his sexual organs and his organs of speech, are biologically designed for interaction. Solitary confinement is, in the long run, the most painful of punishments; among religious ascetics, it is the most rigorous of self-imposed ordeals.

Interaction is the basis of human civilization. Sexual relations and the care of the helpless infant are the most basic forms of interaction, and hence the family, in which these types of interaction occur, is the most basic grouping of human beings. In the most primitive human societies, as also in ape society, the numerical majority of all interactional events takes place within the family. Interactions in other institutions, as we shall see later, become increasingly numerous as the complexity of civilization increases.

SUMMARY

The conditioning process, by means of which human beings learn to adjust to each other and to the non-human elements in their environments, is a mechanical operation which occurs in the nervous system. To begin with, a given stimulus produces an automatic response. For example, the presence of milk in a dog's mouth makes him salivate. If some other object or action is perceived each time in association with the stimulus and just before it occurs, this object or action will serve as a symbol of the primary stimulus and will produce the same result. Thus the sight of milk will produce salivation.

Every symbol is a part of the context of situation, the constant stage properties in which the stimulus-response activity takes place. What happens is that the various elements of the context of a situation which are perceived are registered in special parts of the cortex, and their association in the same context of situation produces an automatic physico-chemical

linkage between these centers of the cortex, so that in future events the perception of one will evoke the other.

If this linkage is to continue, the situation must be repeated in the same context, and it is the elements of the context of situation which are constant, and not those which vary from time to time, that become symbols. All learning requires repetition of the situation which produced the linkage or the association will become extinct; the symbol will lose its meaning. A symbol always represents an habitual relationship between the individual to whom it has meaning and some other individual or object. Thus a throne symbolizes a political relationship, the word "father" a parent-child relationship, etc.

The human infant is born unconditioned, and its emotional responses are violent in intensity, like those of an anaesthetized adult. As the child grows, the conditioning process involves the development of cortical linkage patterns which control and inhibit these responses, so that the child learns to get along with other people. Owing to the helplessness of the human infant, his conditioned reflexes are built up primarily out of the activities of people, rather than out of the context of the non-human elements in the child's environment. He learns first of all to adjust to the other members of his family.

The adjustment of one individual to others takes the form of *interaction,* which is simply what happens when two or more persons are either conversing, working, or performing any other kind of activity together.

Interaction takes place in two kinds of events, (1) *pair events,* with just two individuals interacting, and (2) *set events,* in which three or more are concerned, so that one will originate to two or more others simultaneously. It is the ability to originate in set events that characterizes a person capable of becoming a leader, and it is also through set events and the presence of such persons in them that institutions are formed.

Our habitual adjustments to each other must be established through repetition, by the mechanism of the conditioned reflex. Each individual has an habitual pattern of interaction by which his personality can be distinguished. The ability of individuals to adjust to one another depends upon their habitual interaction patterns.

CHAPTER 4

Equilibrium, and the Development of Personality

I. THE MAINTENANCE OF EQUILIBRIUM BY THE INDIVIDUAL

The process of living consists of a continual sequence of adjustments between individuals. Now that we have studied the way in which these adjustments come about, we will consider the mechanism by which the normal, or average, individual, in the face of many profound changes and disturbances in his relations with others, is able to maintain a relatively stable equilibrium.

In an environment in which the external stimuli remain constant, the action of the organism takes a constant, rhythmic form, comparable to the heart beat and to the rhythm of other internal organs. *Spontaneous activity,* as this type of action is called, is a fundamental physiological characteristic of all living organisms.

Observations on fetuses have shown that their activity rates, which take this form of a constant rhythm, can be systematically modified by changes in temperature, drugs, and other physical and chemical agents; these facts have been confirmed by other observations made on newborn animals. This capacity of animal organisms to alter their rates of spontaneous activity in response to changes of environment provides the mechanism by which organisms in propinquity may adjust to each other's activities. Thus the modifications of the rhythms of different individuals in interaction, discussed in the preceding chapter, may be explained by this means.

Individual Equilibrium and the Internal Environment. We have already seen that the hypothalamus, the autonomic nervous system, and the endocrine glands together maintain a constant internal environment, which is, in effect, a state of equilibrium. A state of equilibrium may be defined as follows: *if a small force is impressed upon a system, a change, or adjustment, takes place within the system, and once this force is removed, the system returns to approximately its previous state.*

Within the internal environment, equilibrium is produced by the related activities of the heart, kidneys, spleen, liver, etc. The activity rates of

these organs vary with the differing adjustments of the individual to changes in the external environment. For example, in the normal unexcited individual the heart rate averages about 72 beats a minute, while the respiration rate is about 20. Similar estimates can be made for the rates of secretion of the various glands, for the rate of blood sugar production by the liver, and for other metabolic rates.

When a disturbance in the external environment affects the autonomic nervous system, changes in the rates of these organs occur. These changes are functions of the adjustment of the organism to the disturbance; hence one could determine the strength of the disturbance and the degree of adjustment by measuring them. Once the disturbance is ended, further information can be obtained about the nature of the equilibrium of the organism by observing the speed at which these variables return to normal, and the total length of time involved in each operation.

In a series of observations of this sort, the investigator could soon discover which of these rates change markedly and which remain relatively constant. In formulating a quantitative definition of the internal environment, the investigator could disregard, in his first approximation, organs with relatively constant rates.

Individual Equilibrium and the External Environment. Let us now turn to the adjustment of the individual to his external environment, and in particular to his relations with other people. This adjustment, like that of the individual to his internal environment, may also be defined as a state of equilibrium. In this case as well, the equilibrium consists of a combination of rates; they are the interaction rates between the individual and all other persons with whom he has relations. The rate at which he interacts in each of these relations is determined by the nature of the adjustment which he makes to the other person's rate; thus his equilibrium is a state of constant balance between the different rates at which he interacts.

If a disturbance affects his relations with one person, as, for example, if his frequency of interaction with this person changes, compensatory changes will take place in his relations to others. Once the disturbance is over, however, he falls back into his old, habitual rates of interaction, and the equilibrium to which he returns is approximately the same as that which existed before he was disturbed.

Such disturbances of equilibrium are taking place all the time, and they may be easily observed. For example, if you watch a group of children playing together, you may notice that from time to time two of the children will increase their rate of interaction by pushing each other and by trying to shout each other down. As this continues, other children, acted

upon by the warring parties, will increase their interaction until the whole group, now divided into sides, is interacting at a heightened pace. After a relatively short period of excitement the rates of the principal contestants begin to decrease, their supporters quiet down, and the group gradually returns to a less hectic play situation; that is, to a state of equilibrium.

Oftentimes, within a family, the parents will punish a child for some misdeed by sending him to his room, thus isolating him completely and preventing all interaction between him and other members of the family. When they finally let him out of his room, he will originate action to his brothers and sisters at a high rate of speed, but, after a short period, these origins of action will decrease in frequency, until he has returned to a state of equilibrium.

Changes in the Equilibrium of the Individual. Throughout life the individual's equilibrium is frequently disturbed, and in cases where the disturbances are severe, his system may be unable to return to the previous state of equilibrium and will, after a period of crisis, adjust to a new state. As an infant, his interactions are limited almost entirely to members of his family, and in the early months of his life, his system of relations may be confined to his parents and nurse. His interactions with other people are of very low frequency; they occur almost entirely on those occasions when friends and relatives of the parents come in to see the baby and to make him respond to their attentions. The stable routine of the baby's world, however, is confined to his relations with the few individuals who take care of his needs. His equilibrium is adjusted in terms of his interaction with them; the occasional visits mentioned above are, in this respect, of negligible importance.

As the infant grows a little older, the direct relations in which he interacts, even within the family, usually become numerous, and there are other relations in which he does not participate, such as quarrels between his parents, which, however, affect his equilibrium indirectly. In a family of ten persons the child has nine direct relations with others, excluding set events,[1] in which two or three older members of the family may perhaps provide an appreciative and responsive audience to the child's activity. Within such a family of ten persons, there are $\frac{n(n-1)}{2}$, or 45 possible relations. Of these 45, 9 are direct relations between the child and his immediate kinsmen, while 36 are indirect relations which may also influence him. In such a situation, a wide range of possible states of equilibrium may be found.

[1] See page 37.

Even in small groups, however, where two or three individuals only are involved, there is considerable opportunity for differences in equilibrium to occur. These differences are made up of variations in (a) the frequency of events (i.e., how often one person sees the other), (b) the origin-response ratio, (c) the interaction rate within the events, and (d) the degree of synchronization of the individuals.

We know from our own experience that systematic differences are to be found between the interaction rates of individuals in small families. Let us take, for example, the case of a father, a mother, an older daughter, and an infant son. In one such family, the child may interact at a much higher frequency with his mother than with his father, and little with his sister; in another, he may have a low frequency with both his father and mother, and a high rate with his older sister, who habitually takes care of him. Different types of families, like these two, are found as standard forms in different societies throughout the world. In a later chapter, we will go into these variations in some detail.

Within a small family group of four persons, as described in the last paragraph, the nature of the infant son's equilibrium depends not only upon his interactions with the other members of his family, but also upon their interactions with other people. For example, if the father is away from home much of the day, his interaction with his son will have a much lower frequency than that between mother and son. The frequency of the son's interaction with his older sister will, furthermore, depend upon how much older she is, i.e., upon the extent to which she satisfies her need for interaction by her relations with people outside the family. She may be only a year or two older than her brother, and the two children may play together; she may, on the other hand, be several years older and may interact almost entirely with a neighborhood group of children of her own age.

As a child passes beyond the stage of infancy, he is obliged to make frequent adjustments to new people. Since his capacity for interaction has definite limits, his old relations decrease in frequency as his new ones are built up. During the early years of his life, his interactions are limited to the family and to play groups of two or three children of his own age. After a few years of this, he goes to school, where he learns to interact in regular and orderly ways with other children as well as with the adults who direct them. As a result of this, his interaction within the family is reduced.

Years of this conditioning process take place, during which his relations with others change, until at last the time arrives when he leaves school, goes to work, marries, has children and watches them go through

the same process. The life of the individual is, therefore, a constant process of modification, by which the individual equilibrium is adjusted to changing situations.

Through all of these changes, however, there runs a common thread: the equilibrium of the individual in middle life is clearly similar to that which he possessed when he was young. This similarity is found because a person's interaction rates become fixed quite early in life. Even though serious disturbances of personality may develop later on, each new state of equilibrium can be shown to be a modification of a recognizable basic pattern, produced by the pressure of the individuals with whom the interaction takes place.

II. THE EQUILIBRIUM OF GROUPS

States of equilibrium are characteristic not only of individuals, but also of groups of individuals. In other words, the individuals of whom a group is composed adjust their interaction rates to each other; as they separately attain equilibrium, the group attains it likewise. Therefore a disturbance which upsets the equilibrium of one member will affect the others also.

If one of the members of a family becomes sick, we can observe how the relations of the group change in response to the new situation. This change is particularly evident if the sick person is one who works in an office and is habitually away from home most of the day. The daily visits of the doctor introduce a new person into the system of relations which we are studying, a person, furthermore, to whom all members of the family have to adjust. Secondly, the constant requirements of the patient greatly increase the frequency of interaction between him (or her) and the members of the family who live at home. In the third place, the normal interaction rates between the members of the family living at home are disturbed. As the patient's health improves, these disturbances of the family equilibrium decrease; when the patient returns to work, the quantitative character of the relations within the family becomes approximately what it was before the illness started.

At this point, it may be profitable to remind the reader that the equilibrium of the internal environment, the equilibrium of the individual in relation to others, and the equilibrium of the group are similar and related phenomena. In Chapters 2 and 3, we have pointed out that disturbances in the external environment produce consequent disturbances in the internal environment, and vice versa. The actions of others stimulate the autonomic nervous system, and a change in the internal environment, as for example a severe illness accompanied by a rise in temperature, produces marked

changes in the interaction rate between the affected individual and his group.

Since the equilibrium of an individual depends upon the differences between the interaction rates of the persons with whom he interacts, one of the commonest phenomena which can disturb his equilibrium is a change in the personnel of his group. Changes of this type include the loss of a member, the substitution of one member for another, and the addition of a new individual to the already existing personnel.

If one wishes to discover whether or not a given group of individuals (for example, five persons) has attained a state of equilibrium, he may do so by applying two tests. The first of these is to observe whether or not the rates of interaction between the individuals in the group are constant within clearly defined limits; that is, whether or not significant increases or decreases are taking place in the frequency of events, in the origin-response ratio, in the interaction rate within the event, and in the degree of synchronization. If the rates are constant and no such changes are taking place, equilibrium has been attained.

The second test is to see whether or not, after a disturbance takes place, the rates return to their previous values. They will do this if the group is in a state of equilibrium. When the personnel of such a group is changed, however, the previous state of equilibrium cannot be restored, unless the new member has exactly the same interaction rate as the person whom he has replaced, which rarely happens.

When one member of our group of five individuals dies, changes in the relations of all members must take place before the group can attain a new state of equilibrium. In the development of this new equilibrium, each individual must adjust his own rates in some way. Let us suppose that one of the members, A, has been interacting daily for about an hour a day at a given rate with B, the deceased member. If A is to maintain his state of equilibrium, or at least return to a state somewhat similar to his old one, he must find some outlet for the interaction to which he was accustomed. This means that, in order to make up for what he has lost, he will have to increase his interaction with one or more persons, either within the circle of the surviving members of the group, or outside it. His interaction rate, and the rates of the persons to whom he makes his new adjustment, must be synchronized if his previous equilibrium is to be restored. If this cannot be done, he will try to attain a new state of equilibrium at a different level of interaction.

Similar readjustments take place when a new individual is substituted for the deceased member. In this case, the new person will almost certainly

have an interaction rate different from that of his predecessor, and he will consequently produce a different state of equilibrium in each of the other members. The amount of interaction which he contributes may be greater or smaller than that provided by the previous member; the new man may also have a much higher origin rate, or again, he may have a slow and phlegmatic rate of interaction. In any case, the other members of the group will be obliged to adjust to him, as he will to them. This process of mutual adjustment takes place slowly; the original members must be conditioned to the newcomer, and the reverse.

Let us consider a third situation, in which a new individual is added to the group without the loss of an original member. In this case, two results usually occur; the older members of the group adjust themselves to the newcomer, and the increase in the number of individuals concerned often causes a decrease in the individual interactions that take place. The resulting interactions rates represent a new distribution of the separate rates of the constituent individuals.

The process of adjustment which takes place within a group as the aftermath of a disturbance is marked by cyclical fluctuations; by days on which the members of the group fail to adjust, interrupt each other, become angry, and are unable to work together—days on which the regular routine, to which the members have been conditioned, is upset. As the group gradually regains its equilibrium, the range of these fluctuations decreases and the rhythm of the routine interactions becomes more constant.

III. THE STABILITY OF EQUILIBRIUM

As we can readily understand through our knowledge of the conditioning process, the degree to which a state of equilibrium becomes stable depends upon the length of time that the interaction rates, of which the equilibrium is composed, remain constant. This is equally true in respect to individuals and to groups. The longer, therefore, the individual or the group maintains his, or its, equilibrium, the more fixed and automatic will the conditioning of the individual, or individuals, concerned become.

The degree of stability has an important bearing on the ability of the individual or group to withstand disturbances of equilibrium; as a rule, the greater the stability, the stronger and, at the same time, less elastic is the state of equilibrium. For example, a group with a high interaction rate and a long history of continued stability will maintain its equilibrium under the impact of powerful external forces, but an internal change, such as the loss of a member, will produce serious effects, and its adjustment

to a new equilibrium after the loss will be a slow and difficult process, if such an adjustment can be made at all.

There is, therefore, a great difference between groups, as well as between the individuals of whom they are composed, in their ability to withstand major changes of environment; and this ability depends in part, as we have seen above, on the relative stability of the states of equilibrium concerned. Such differences between individuals, whether we study them separately or in groups, are commonly known as *differences in personality.* We shall now study the formation of personality, and see in what ways changes in equilibrium help to produce the different types with which we are all familiar, and which are found in all societies.

IV. THE CLASSIFICATION OF TYPES OF PERSONALITY

It is a common practice to make distinctions between individuals on the basis of their habits of behavior, and to classify them into types in terms of these distinctions. Among the words which are usually employed for this purpose are "aggressive," "timid," "choleric," and "phlegmatic." The layman also uses such terms as "abnormal," "pathological," and "natural leader." Psychologists and psychiatrists have developed a more specialized vocabulary in order to describe in more detail the variations in personality which are encountered in everyday life.

The layman's classification is based largely on differences in the kind of activity in which the individual indulges, that is, in the overt form that his actions take, and in the content of his speech. The classifications of psychologists and psychiatrists are based partly on the same criteria, but in making their diagnoses, they also consider differences in the internal environment of the individual, as observed by various means. Differences in personality can, however, be defined in terms of purely objective criteria, on the basis of our study of interaction.

One of the main reasons why the terms used in daily life, as exemplified above, cannot serve as satisfactory labels for precise definitions of personality is that they imply the existence of a set of separate and distinct compartments into which all persons must be pigeonholed. Such a set of mutually exclusive compartments cannot, obviously, exist; students who have classified personality in these terms have usually selected extreme types considered to be opposites, and have forgotten that the differences between these types are matters of degree rather than of kind.

This is particularly borne out by an examination of the classification of personality into aggressive and timid types, dominant and subordinate, extrovert and introvert; all of these terms seem to imply, at least in part,

variations in the origin-response ratio of interaction. It is clear that all individuals are not clustered about the extremes of this ratio; there is, in fact, a systematic progression from the type of individual who originates action in almost every event to the Caspar Milquetoast type, who can rarely if ever bring himself to take the initiative.

If we try to use the conventional terms indicated above, and classify individuals into two categories on the basis of the origin-response ratio, we encounter several difficulties at once. For example, how can we determine the point in the progression from a high to a low origin rate which marks the borderline between aggression and timidity? Again, how can we determine the relative aggressiveness of two individuals, when one of them maintains a constant ratio of aggression in all his relations, and the other is high in some and low in others? Furthermore, when two individuals seem equally aggressive, but one interacts in fifty events a day and the other in a thousand, how can we determine whether or not their degrees of aggressiveness are actually the same? Have we any assurance that the origin-response ratio of the man who interacts in only fifty events might not decrease if his daily number of events increased?

It is clear from this that personality is not a single or simple variable which can be measured in terms of a single linear scale; it is rather the combination of a number of variables, each of which has a scale of its own. Individual differences in personality, therefore, may be composite differences which must be expressed in terms of all variables concerned. Before we can define personality with any accuracy, we must first decide what variables we shall select as significant for our study, and what limits we shall set to the categories within each variable. Only by this process can an accurate and objective classification be made.

Our classification of types of personality must be a reflection of the different states of equilibrium attained by different kinds of individuals, since the state of equilibrium of each individual represents his total adjustment in his relations with others, and is, therefore, the basis of his personality. The total adjustment of each individual is, in effect, his interaction rate, which in itself is a composite. The elements of which it is composed are the variables which we need in our study of personality, and all of them are capable of measurement. These variables are: (1) the amount of interaction; (2) the frequency of interaction; (3) the origin-response ratio, already mentioned in the discussion of timidity and aggression; (4) the rhythm of the interaction rate (which is also called the *basic* interaction rate); and (5) the degree of synchronization (i.e., of adjustment in interaction).

A complete study of personality differences based on these measurable variables has not yet been made, although the work is well under way.[2] In the meanwhile, for present purposes, we shall review existing classifications which are in common usage, and interpret them in terms of the variables listed above, which constitute the interaction rate.

V. EXTREME TYPES OF PERSONALITY

The most extreme types of personality which are usually recognized are those which are called psychotic and neurotic; they afford us the most instructive examples of variations in personality, since the differences between them are clearcut and easily perceived. These pathological forms may be recognized immediately by the fact that the capacity of the individual to adjust to others is sharply limited in the neurotic type, and in the psychotic, completely absent most of the time. This does not mean, of course, that neurotics and psychotics are *never* able to adjust to others, since the capacity of the individual to adjust is a matter of degree rather than of kind, and since this capacity is subject to fluctuation.

A. The Psychoses

If you walk through an insane asylum, you will notice that the behavior of the inmates in their relations to others differs markedly from that which you experience in ordinary life. These differences reflect extreme variations of the interaction rate. Three principal categories are distinguished clinically; the *schizophrenic,* the *manic,* and the *depressive.* The manic and the depressive states are often considered to be different phases of the same psychosis, and patients are found who alternate between the two states, but this is not invariable. The distinguishing character of all these psychoses is the inability of the individual to adjust to other individuals, although this inability takes different forms in the three types.

Schizophrenia. The differences between schizophrenics and other types of the mentally ill are best observed in the interaction rate of the individual. In a psychiatric interview, or even more so in an ordinary conversation, the schizophrenic is characterized by the continual occurrence of a so-called latency of response, a term which psychiatrists use to refer to the failure of a patient to respond immediately to the ending of action by the other person. This latency of response is also clearly evidenced in another way in what is called "blocking." The patient is talking, and suddenly in

[2] "Clinical Implications of Measurements of Interaction Rates in Psychiatric Interviews," by Chapple, E. D., and Lindemann, E., to be published in *Journal of Psychiatry,* 1942.

the middle of the action becomes silent for no apparent reason. Although this failure to respond is the most obvious part of the schizophrenic's interaction rate, he is also characterized by bursts of activity which once again have no obvious relationship to the actions of the other person. It is this element which enables one to distinguish between the failure to respond of a schizophrenic and that of a person who is merely depressed. In the latter case, the length of actions reaches a minimum, and within a single interview there are no alternations of pronounced activity and latent response periods. Moreover, in schizophrenia, a long latent period may occur in direct association with a long action. In a depression, when the actions grow longer, the silences grow shorter.

These profound disturbances in the interaction rate, in which the individual seems to be controlled almost entirely by the inner environment and scarcely affected by the individuals with whom he is talking, are accompanied by similar but less easily defined distortions of speech and action patterns. Incoherence, giggling, and odd behavior are very frequent. These, however, may occur in other types of mental illness; the interactional differences seem, in view of work already done, to be the safest diagnostics.

Human Relations and Schizophrenia. The disturbances which bring about the onset of schizophrenia seem to follow a uniform course. The individual is a member of a small system to which his interactions are confined, and in which he has a very low origin-response ratio. Ordinarily, in his relations outside the small system to which he belongs, his schoolmates, fellow-workers, or other associates, will originate action to him, but he will be unable to interact with them for any length of time. We have here, in other words, a situation in which an individual is conditioned to interact at a high frequency with a very small number of people, and is able to originate very little action to others.

The onset of the schizophrenic condition usually follows a serious disturbance in the family system in which the individual habitually interacts, caused by the death of one of the members, by a long illness, or by some other diminution of the individual's interaction rates. When such a disturbance occurs in his equilibrium, some adjustment takes place, and this adjustment will also affect other members of his group. Unfortunately, however, due to the patient's inability to originate action and to the marked disparity between the high interaction rates within the family and the low ones which he experiences outside, his system of relations has become so isolated that there is no way in which he can make up for the loss of interaction. The result is that those compensatory changes which he can make

take place within the limited personnel of his family group, and the quantitative characteristics of the relations within this group are such that little increase is possible, since the other members of the family are able to make their adjustments by increasing their outside relations. Thus the patient is obliged to readjust at a reduced total interaction rate, which may sink to the level of clinical schizophrenia.

Let us take as an example a family in which our subject is a small girl, A. A has several brothers and sisters, but all of these pick on her except one sister, B, who interacts with her habitually. The father is often away from home, and when he appears, he either orders the children about or ignores them. The mother, on the other hand, is always at home, and pays much attention to A; in fact, the mother babies A to make up for the difficulties which A has with the other children. In school A is aloof and plays little with the others; she is considered queer.

Later on, A graduates from school and goes to work; she is still aloof, and has little to do with her fellow-workers. She still depends for almost all her interaction on her sister, B, and on her mother. B, however, gets married and goes away, and the mother dies. The father and the other children have interests outside the family. A becomes schizophrenic and is taken away to the hospital.

The Manic-Depressive Psychosis. The manic-depressive psychosis is usually regarded as a cyclical fluctuation between two extremes in activity, the manic state and the depressed state.[3] In the manic state, the patient is hyper-active; he originates action to everyone in sight with a high frequency. Within each event, he talks for longer and longer periods, and his silences become shorter and shorter, until, in a well-developed case, he talks and acts almost continuously.

The manic responds with extraordinary rapidity to changes in his environment, and where he has a large audience, the interaction is fast and furious. In a hospital, for example, he continually originates to members of the staff and to the other patients, and is always making suggestions as to what ought to be done.

In the depressed stage, the patient's interaction rate becomes almost the complete reverse of what it was during the manic stage. His actions become very short, and his silences long; after he has been spoken to, he remains silent for a long while before making any response. While these disturbances in his interaction rate are taking place, changes are also in

[3] However, this cyclical variation is often not found, and in such cases the patients seem to be either manic or depressed, and do not oscillate.

progress in his autonomic nervous system; his metabolic rate is lowered, and, in cases of extreme stupor, he makes no response whatever to the environment, and thus is totally unable to interact. In the manic stage, on the other hand, his metabolic process is accelerated.

Superficially, the depressed state of the manic-depressive psychosis resembles the stuporous state of schizophrenia, and obviously, when the individual has reached a state of complete inaction, no distinction can be made. Ordinarily, however, the schizophrenic is not totally inactive during his period of stupor; although he preserves long silences and fails to respond to others, he also performs, from time to time, moderately long actions. The manic-depressive, on the other hand, reduces all his actions to a minimum while in the depressed stage. The schizophrenic may also, at odd moments, interrupt the psychiatrist, while the depressed person rarely, if ever, does this.

The changes in the equilibrium of the individual which produce the manic-depressive psychosis differ from those which bring on schizophrenia, and which we have already described. The incipient manic is characteristically a person who interacts with high frequency within his family system, and who, unlike the schizophrenic, has a high origin rate. He further differs from the schizophrenic in that he also interacts frequently with persons outside the family bounds.

When a disturbance in the family system (comparable to that which drives other individuals to schizophrenia) occurs, with the result that the individual's interactions within the family decrease, or that his ability to synchronize his interactions with those of the rest of the family is impaired, he will increase the frequency of his interactions outside the family, and his ratio of origins in these interactions will also increase. If disturbances of this magnitude within the family system keep on occurring, the compensatory changes which the individual makes will also increase, until the point has been reached where the individual is definitely manic in his behavior.

The depressed state, in its cyclical form, seems to be a period of rest to make up for the abnormally rapid increase in the manic's interaction rates. Each person, manic or otherwise, seems to possess an upper and a lower limit between which his activity rate can rise and fall; when one of these limits has been overstepped, the compensatory change will cause the opposite limit to be extended as well. Once a sequence of oscillations of this kind has been set in motion, the magnitude of the swings becomes cumulative, and the activity rates of the patient deviate further from the limits of normal behavior. In other words, the patient becomes increasingly

manic and increasingly depressed, until he has reached the clinical stage of his psychosis and needs to be cared for in an institution.[4]

B. The Neuroses

The milder psychoses, which are ordinarily referred to as neuroses, present an interesting contrast to the psychoses which we have just considered. In the psychoses proper, as we have seen, the patient's interaction rate progressively breaks down or becomes distorted, producing a distinct maladjustment between the patient and other people. In the neuroses, on the other hand, the disease is not progressive, and the individual retains his ability to interact, and thus is able to adjust in some way to others. The interaction rate which the neurotic develops has a narrow range of variability, so that as a result he cannot adjust to a wide variety of people; ordinarily the new state of equilibrium which he develops after his disturbance limits his capacity for interaction in society.

Neuroses may be roughly classified under four headings: (1) Hysteria, (2) Anxiety, (3) Obsession, and (4) Neurotic Depression. All four types seem to develop out of a single kind of family situation; the form which the disease takes seems to be determined by the quantitative character of the interaction rate of the individual.

The prospective neurotic is characteristically a member of a system of relations much like that of the psychotics. Unlike these individuals, however, his condition is produced by a marked increase in origins to him and in his interaction rate with others. In trying to restore his system to equilibrium, he tries to escape from, or reverse the order of, the increased interaction rates. The result includes characteristic interaction rates and associated verbal and somatic reactions.

[4] Although other types of psychosis are distinguished by psychologists, the evidence seems to indicate that these may be dealt with as sub-forms of the two major psychoses. The best known of these types are involutional melancholia and paranoia.

Involutional melancholia seems, on the basis of present evidence, to be a subdivision of the manic-depressive psychosis. It comes lates in life, and ordinarily, if not exclusively, among women, in association with the menopause. Case histories seem to show that its principal distinguishing feature is the late period in life at which it occurs.

Paranoia seems to include some cases which fit into the manic phase of the manic-depressive psychosis, and others which belong with the paranoid type of schizophrenia. True paranoia, so-called, is characterized by a moderate interaction rate with a high origin rate, and it is ordinarily associated with a single institution, such as the church or the law courts. Incipiently paranoic individuals are frequently preoccupied with litigation, which affords them the opportunity to interact with a high rate of origins; they react violently to origins from others.

Hysteria. In hysteria, for example, a number of disturbances occur in the individual's central, somatic, or autonomic, nervous system which enable him to maintain his equilibrium. These disturbances may include headaches, anaesthesia of the senses, tics, hiccoughing, vomiting, inability to urinate, and loss of appetite, as well as the occupational neuroses, such as writer's cramp, and the war neuroses, such as shell shock.

All of these symptoms, which are found among individuals with a high origin and high interaction rate, seem to afford a means for them to escape from unpleasant social environments. By the involuntary acquisition of these ailments, the individual is able to avoid poorly synchronized interaction and to increase interaction at the rates to which he has become accustomed. In ordinary language we would say that such a person, by virtue of his ailment, demands attention comparable to that which his mother once showed him, and that the symptoms of hysteria provide a means by which he may retreat from regular interaction and at the same time enable him to maintain the hyper-active "emotional" type of interaction, which is characteristic.

Anxiety. The anxiety neurosis seems to occur in individuals having a moderately high interaction rate and a high origin rate. The interaction rate is, however, not as high as in the case of hysteria. The most characteristic aspect of the anxiety neurosis is the autonomic disturbances to which the individual is subject; the patient is literally anxious. His sympathetic nervous system is over-active. These symptoms occur even during slight disturbances of the equilibrium. They reflect themselves in the interaction rate, by combining with the moderately high interaction rate infrequent interruptions of the other person and a marked tendency to fail to respond for very short intervals.

Obsession. Obsessive individuals are ordinarily persons whose interaction rates are stable and fixed. They have unusually low origin rates, much lower than their interaction rates (which range between moderately low and moderately high), and their overt symptoms consist of the performance of compulsive actions, often highly elaborate, either at regular intervals or on occasions when a number of people are present. Some obsessive neurotics wash their hands dozens of times each day; others step only on cracks when walking on cement sidewalks. Everyone has obsessions such as these at some time during his life, especially during childhood and adolescence; it is only when they become pronounced and of long duration that they merit attention. They result from the attempts of the organism to maintain a state of equilibrium in the face of disturbances occurring at uneven intervals and at rates to which they cannot adjust satisfactorily.

Neurotic Depression. There are many cases of individuals who are depressed, and whose interaction rates resemble those of psychotics, but to a minor degree; they are considered to be neurotic rather than psychotic. These depressions seem to occur among individuals with a low interaction rate, who are upset in their state of equilibrium by an increase in interaction and origin rates. These individuals have a low origin rate, together with their low interaction rate, and an increase gives them an attack of the "blues." These neurotic depressions are easily distinguished from the psychotic depression, because the rates of the neurotic individuals are not as pronounced as those of the psychotics, and because, in every interview, there will be periods of moderate activity without pronounced failures to respond. Many of the so-called neurasthenias, a term now gradually going out of use in this country, would be placed in this category.

C. Psychotics, Neurotics, and Society

In different societies throughout the world, psychotic and neurotic individuals have different opportunities for adjustment. In our own present-day society, psychotics are confined in institutions, because the presence of persons who cannot adjust to others is a serious and disturbing force in a civilization in which the system of relations is highly complex, and in which even minor changes of routine may have far-reaching consequences. In a simpler society, in which such complex organizations as banks and factories do not exist, such individuals may, on the other hand, live as ordinary members of the community. In many societies, as we shall see, the religious leaders are selected from among the abnormal members, and in some cases, as among the Chukchi of northeastern Siberia, an abnormal son is regarded as an asset to a family, and is apprenticed to a shaman [5] to learn his trade. When such individuals play prominent parts in a society, their personalities do not tend to deteriorate, since an environment is created for them in which they are able to maintain an equilibrium different from that of their so-called "normal" associates.

Although psychotic and neurotic individuals show the most striking differences which are to be seen in interactional systems, they are always in the minority; most of the members of every society are able, within limits, to maintain ordinary types of adjustment. Owing to the accidents of conditioning, the adjustments of these "normal" individuals to the members of their families and to their other associates are relatively stable, and their relations are not limited to small numbers of people. Marked changes in their relations will disturb them, but the systems of relations in which

[5] A religious leader who communicates with spirits. See Chapter 16.

leader a successful adjustment with his followers, so that they will voluntarily heed his advice and obey his commands. The *well-adjusted leader,* the powerful and beloved king or president, the successful administrator, *is a person who can also respond in events in which he interacts with only one other person,* and which we call "pair events." He is, in other words, a man who originates action in public, but who gives his followers the opportunity to do the same to him in private. Unless he can do this successfully, the equilibrium of his followers may be disturbed, and if this happens, the resulting change in interaction rates may produce new relationships, so that, through the rise of new leaders, a once homogeneous group will break up into segments. Later on in this book, we shall examine situations of this kind in detail, and we shall see that the leader, with his special type of personality, plays a significant part in the development of societies, and of their various institutions.

VII. THE DEVELOPMENT OF PERSONALITY: HEREDITY VS. ENVIRONMENT

At this point in our study of human behavior, the old question arises, "What causes the differences in personality which we have described?" This is a part of the general question of the causation of all differences in living forms, a question which has been debated and argued for centuries, and which has never been fully settled. It is usually stated in terms of an opposition of two forces, heredity and environment. In order to explore the premises of this question and to state them clearly, we can do no better than to quote Jennings, as follows:[6]

> . . . the distinctive work of science is the modification, the reconstruction, the abandonment of old ideas; the construction of new ones on the basis of observation. This, however, is a distressing operation, and many refuse to undergo it; even many whose work is the practice of scientific observation. The old ideas persist along with the new observations; they form the basis—often unconsciously—for many of the conclusions that are drawn.
>
> This is what has occurred in the study of heredity. A burden of concepts and definitions has come down from pre-experimental days; the pouring of the new wine of experimental knowledge into these old bottles has resulted in confusion. And this confusion is worse confounded by the strange and strong propensity of workers in heredity to flout and deny and despise the observations of the workers in environmental action; the equally strange and strong pro-

[6] Jennings, H. S., *The Biological Basis of Human Nature,* New York, W. W. Norton, 1930, pp. 205-216; also quoted in Korzybski, Alfred, *Science and Sanity,* Lancaster, Pa., 1933, pp. 5-6.

pensity of students of environmental effects to flout and deny and despise the work on inheritance. If one accepts the affirmative results of both sets, untroubled by their negations, untroubled by definitions that have come from the past, there results a simple, consistent, and useful body of knowledge; though with less pretentious claims than are set forth by either single set.

Our first fallacy springs from the situation just described. It is:

I. The fallacy of non-experimental judgments, in matters of heredity and development. . . .

Our second general fallacy is one that appears in the interpretation of observational and experimental results; it underlies most of the special fallacies seen in genetic biology. This is the fallacy that Morley in his life of Gladstone asserts to be the greatest affliction of politicians; it is indeed a common plague of humanity. It is:

II. The fallacy of attributing to one cause what is due to many causes. . . .

III. The fallacy of concluding that because one factor plays a role, another does not; the fallacy of drawing negative conclusions from positive observations. . . .

IV. The fallacy that the characteristics of organisms are divisible into two distinct classes, one due to heredity, the other to environment. . . .

VII. The fallacy of basing conclusions on implied premises that when explicitly stated are rejected. . . .

Many premises influencing reasoning are of this hidden, unconscious type. Such ghostly premises largely affect biological reasoning on the topics here dealt with; they underlie several of the fallacies already stated, and several to come. . . .

VIII. The fallacy that showing a characteristic to be hereditary proves that it is not alterable by the environment. . . .

IX. The fallacy that showing a characteristic to be altered by the environment proves that it is not hereditary. . . .

It appears indeed probable, from the present state of knowledge and the trend of discovery, that the following sweeping statements will ultimately turn out to be justified:

(1) All characteristics of organisms may be altered by changing the genes; provided we can learn how to change the proper genes.

(2) All characteristics may be altered by changing the environmental conditions under which the organism develops; provided that we learn what conditions to change, and how to change them.

(3) Any kind of change of characteristics that can be induced by altering genes, can likewise be induced (if we know how) by altering conditions (This statement is open to more doubt than the other two; but it is likely eventually to be found correct.). . . .

X. The fallacy that since all human characteristics are hereditary, heredity is all-important in human affairs, environment therefore unimportant. . . .

XI. The fallacy that since all important human characteristics are environmental, therefore environment is all-important, heredity unimportant, in human affairs.

What interests us particularly at present is one phase of the total problem with which Jennings was concerned. We would like to learn the reasons for the differences between the *personalities* of individuals, which may be defined as *their combined systems of emotions and interactions.* We would like to know what elements in the behavior of organisms, and of human organisms in particular, are inherited, and which ones are produced by the action of the conditioning process on a complex of inheritable potentialities.

A. The Inheritance of Personality. In Chapter 3, in our discussion of the conditioning process, we stated that the activity of the organism and the associated reflex patterns of the autonomic nervous system are present in animals at birth. Spontaneous activity, furthermore, which has been shown to occur in fetuses, has been studied in both newborn and adult animals, and these studies have some bearing on our present problem.

Crozier and his associates, in a number of studies of the activity rates of organisms, have shown that these rates vary as functions of such independent (i.e., environmental) variables as temperature. By raising the temperature of animals and by measuring, at each temperature level, the activity rate of such spontaneous movements as respiration in mammals, gill movements in fishes, the repetitive chirping of tree crickets, and the bodily movements of mice, they have shown that a single law governs all these phenomena, and that each race of animals is distinguishable from other races by precise mathematical properties derived from this law.

From further studies, Crozier has shown that *the action of a gene is to determine a capacity for performance;* as, for example, that the response of an animal to visual stimuli is controlled by inheritable factors. From this, however, one must not assume that a change in the molecular constitution of a gene cannot occur in response to environmental stimuli; such changes, which alter the gene's capacity for performance, have, in fact, been made in the laboratory. The point must be made, however, that *the activity rate of an organism within a genetically homogeneous stock is constant and characteristic.*

When we try to apply these facts to a consideration of the inheritance of activity rates in man, we are faced with a basic difficulty; within the human species, no races in the genetic sense have ever been isolated—in fact, they probably do not exist. So much cross-breeding goes on in human

groups that only in extremely isolated populations would conditions which even approach genetic homogeneity be possible.

This does not mean that the factors which determine activity rates in man are not inherited, as is the case with other animals, but merely that we cannot predict how they will be inherited, since, in a cross-bred population, the variations which come together within a single organism are much greater than those in a race, and since the resultant genetic situation is too complex, in general, for us to follow.

As we have seen, the interaction rate is the basis of personality. One of the elements of which the interaction rate is composed is its rhythm,[7] measured in terms of the frequency of alternations of actions and silences; this rhythm seems comparable to the activity rates of movements in animals which Crozier studied, and which he found to be inherited. One might, therefore, expect that the rhythm of the interaction rate would likewise be inherited, and evidence has already been collected which indicates that this is true. At least one aspect of personality, therefore, is apparently hereditary.

B. Conditioning and Personality. As we have just seen, it is extremely difficult to study the mechanism by which inheritance plays its part in determining human personality, as well as to determine the extent of its influence. It is much easier, however, to observe the work of environment, and from such observation it seems apparent that the conditioning process has more to do with producing the details of personality than has any inheritable property, or combination of properties, of the interaction rate. This is illustrated by the following examples.

During the last few years, due largely to the work of Professor Robert M. Zingg of the University of Denver, a work which has been popularized by Gesell in his book,[8] there has been a revival of interest in feral man, that is, children who have been brought up by animals or at least have run wild. There are several authenticated cases, notably the Wild Boy of Aveyron, and Kamala, one of the two Wolf-girls of India described by Dr. Gesell. Both of these children lived for some time in the wild, the former till about twelve years old, the latter till seven. They were each subjected to long and intensive retraining. In both cases, it was clear that even in spite of this training, they did not achieve anything like full human behavioral patterns, particularly in their capacity for learning. Gesell says that the Wild Boy attained a six-year level of performance and remained there until his death at the age of forty, while the Wolf Girl, at the age of seven-

[7] See p. 51.

[8] Gesell, A., *Wolf Child and Human Child,* Harper and Brothers, New York, 1940.

teen, reached a level of two and a half years. It took Kamala, who was stolen by the wolves in infancy, six years to learn to walk and to talk with a vocabulary of thirty words. When first captured, she crawled on all fours and was conditioned to howl at fixed intervals each night like the wolves.

The importance of these examples lies in the fact that the non-human environment in which they were placed at an early period of their lives severely inhibited the development of a normal personality. They became little more than domesticated animals, although Gesell believes that Kamala might, if she had lived, have improved her performance to beyond the thirty-month level, and perhaps might have even reached a sub-adult performance. There is, however, no evidence to prove this, and the example of the Wild Boy and our knowledge of performance changes after the age of 17 are against it.

Within each human family, the individual relations between the component members differ markedly. Among the children, the age of each child in relation to the ages of the others, the sexes of the children, the nature of the state of equilibrium within the family immediately following the birth of each child and in the early years of its life, the birth order of the children, and the way in which they build up relationships with each other and with their parents, are all factors which are concerned with the development of their individual personalities. No two grow up under identical circumstances; even identical twins, contrary to what their parents may think, show marked differences in the relationships which they establish. Recent studies of the Dionne quintuplets[9] have shown that the five sisters, who are considered to be genetically homogeneous, that is, the result of the fission of a single egg, have marked differences in their origin rates and in the frequencies of their interactions. Unfortunately we do not yet know whether or not the rhythms of their interaction rates vary in the same way.

There is an abundance of collateral evidence to show that conditioning plays an obvious and important part in the development of the individual's origin rate, and in habituating him to specific frequencies of interaction. The child who is brought up in isolation from other children of his own age, and who is obliged to terminate to his parents continuously, will learn to adjust at a low rate of origins, whereas a child brought up in a large family, who is encouraged to originate action and is free to play with

[9] Blatz, W. C., Millichamp, D., and Charles M., *The Early Social Development of the Dionne Quintuplets,* Univ. of Toronto Studies, Child Development Series, No. 13, 1937.

many children outside the family, can more easily develop the capacity for leadership.

Changes in the environment which affect the equilibrium of an individual may also affect his personality, particularly if these changes force him to turn his attention from one institution or system to another. Thus the death of a member of the family with whom an individual has had close relations may turn him to a strong interest in the church, where the interactional system is quite different from that within the family institution in which he was brought up, and hence a major adjustment of personality may result.

VIII. PERSONALITY AND "INTELLIGENCE"

One of the commonest judgments which people make of their neighbors and acquaintances is that of a composite quality usually described as "intelligence," and it has long been the aim of psychologists, educators, and others to devise some objective means by which this supposed quality could be measured. As a result of the work of Alfred Binet, a French psychologist, methods of rating individuals, known as I.Q.s, (Intelligence Quotients) were at length developed; these supposedly tested the capacity of the individual to respond to certain cultural stimuli to which he had been conditioned. Many of these tests took the form of verbal associations, but others were non-verbal, involving the length of time it took the subject to match colors, shapes, and the like.

It was at first believed that these tests could be applied to peoples in all stages of culture and that, for example, Australian Blacks, American Indians, White Americans, and Frenchmen could, by this means, be given quantitative ratings on a single scale. It was soon found, however, that the element of differential conditioning could not be eliminated; for two reasons: (1) certain kinds of performance or symbols to which People A have been conditioned from childhood may have no significance whatever to People B; (2) even if these kinds of performance or symbols have the same significance to both, People A may have been conditioned to them with a different intensity of training than was the case with B.

For example, in a test given Samoans, one of the problems was to tell what was wrong with a picture of a house; the answer was that the house had no chimney. Samoan houses, unfortunately, are also without chimneys; hence the examinees failed this question. On another occasion, a number of West Africans were tested as to their ability in matching colors; West African art is concerned with form and surface texture, and the conditioning of West Africans to color discrimination is little developed. The examina-

tion no doubt showed this, but proved nothing about intelligence. In another examination, American Indians were shown to be equal to whites in general performance, but slower. Speed is not at a premium in present-day Indian life, as it is in that of many whites.[10] The futility of this type of research is obvious; comparative I.Q. studies designed to measure the relative cultural conditions have been, for the most part, abandoned.

Until recently, however, it was still believed that within a homogeneous group, representing a single culture, the I.Q. tests would provide a useful measure of this supposedly inherent capacity, which all investigators agreed to be very important, although they could not agree upon the identity of the factors which composed it, since it was generally believed that the I.Q. value would remain constant throughout the individual's lifetime. However, the work of the Iowa State Child Welfare Station has now shown that this point of view was erroneous.[11]

At this station a systematic reexamination of the same individuals, year after year, was instituted, and it was found that in many cases marked fluctuations occurred. For example, children who attended the University Pre-School showed marked increases over the records of those who did not. Studies were also made of children who were admitted to the state orphanage, and it was found that the younger children of a poor family were brighter, on admittance, than their older brothers and sisters. It was further found that the longer the children remained in their underprivileged homes, the lower their I.Q.s became. When children were taken out of these families and placed in adoptive homes of a higher economic status before they were six months of age, they did not, when examined in childhood, fall into the low average class as expected, but had to be rated as superior.

At the beginning of their study the psychologists were skeptical of the policy of the orphanage superintendent in placing children from feeble-minded, insane, or criminal homes in good families. To their surprise, however, they discovered that these children attained the I.Q.s of their adoptive parents, and this occurred even when the mothers of the children were feeble-minded.

From these amply substantiated studies it is clear that the I.Q. is a product of the individual's environment; the old idea that the I.Q. is an

[10] Nadel, S. F., "The Application of Intelligence Tests in the Anthropological Field," in *The Study of Society,* edited by Bartless, F. C., Ginsberg, M., Lindgren, E. J., and Thouless, R. H., New York, 1939.

[11] Wellman, Beth, "The Fickle I.Q.," *Sigma Xi Quarterly,* Vol. 28, No. 2, 1940, pp. 52-60.

inherited constant is no longer tenable. When children are removed from families which are continually subject to disturbance, and in which crime, constant conflict, or abnormal interaction patterns are the rule, they are able, after removal, to develop stable equilibria, and hence satisfactory interaction rates, and to learn to discriminate between the more complex stimuli of the new environment. Under such conditions they can also build up the capacity for linking these stimuli together, which is implicit in the I.Q. requirements. Thus differences between individuals in the I.Q. seem to depend largely upon the adjustment of each individual in his interaction with others.

IX. PERSONALITY AND ENVIRONMENT

One set of factors which seems to have a considerable effect upon some aspects of personality is the external environment. One field in which this has been scientifically studied is that of nutrition. Richards has shown [12] that among the Bantu-speaking peoples of East Africa, members of those tribes who are habitually undernourished cannot do a full day's work according to the standards set for them by their European employers, and spend much of the day lying around in their huts with a minimum of activity, and hence of interaction. Interaction, in the form of ceremonies and other group events, is at a minimum during those seasons of the year when food is scarce and people are waiting for the first crops to ripen.

Among peoples who are habitually undernourished, it is often found that the leaders get more and better food than their inferiors, and hence their higher interaction rates, particularly in the amount of interaction and in the origin-response ratio, may be partly attributed to a greater amount of physical energy. Among many peoples, members of the leader class can be distinguished from their inferiors by the greater size, weight, and physical strength of the former. Hence their ability to maintain leadership may not be entirely due to inheritance or to conditioning in habits of interaction, but to a combination of either or both of these factors with nutrition.

Among modern, civilized peoples there is probably less difference in the kinds of food eaten than in the amounts, although even in America there are local populations whose diets are limited to certain foods, as in depressed areas of the south where corn grits and sow belly are almost the only foods eaten. Among the so-called primitive peoples, there are whole populations who live almost exclusively on single foods; in India, there are peoples who eat little besides rice, and others who subsist almost ex-

[12] Richards, Aubrey, *Land, Labour, and Diet in Northern Rhodesia,* Oxford, 1939, pp. 34-37.

clusively on fish. In Africa, there are similarly millet-eaters and fish-eaters. Some peoples, such as the Somalis, live largely on milk; others, such as the Eskimo, subsist on the muscles and fats of animals. It would be extremely profitable to make a comparative study of the component elements of personality among such peoples.

The study of the effects of environmental differences upon personality has not yet begun, but it is apparent from the foregoing summary and from other evidence that differences between individuals and between groups of individuals must be partly dependent upon climate and nutrition. In our total consideration of human behavior, we must take this factor into account, and in our study of the differences between the ways in which different peoples have adapted themselves to their environments, it must also be kept in mind.

X. CONCLUSION: PERSONALITY AND HUMAN RELATIONS

No two human beings are exactly alike. People differ not only in the physical attributes of their organisms, but also in the ways in which these organisms operate. These differences are due, as we have seen, partly to inheritance, partly to the conditioning dependent upon the adjustment which the child is forced to make to others, and partly to the influence of the external environment.

These differences, as we shall see later, are always in evidence in the relative ability of individuals to master the details of their external environments and in the ways in which they are able to interact with others. In simple societies in which the adaptation to the environment does not require complex techniques, complex relations between individuals, or both, there is little incentive for a specialization of activity beyond the differentiation between male and female, and young and old; hence there is relatively little opportunity for individual differences in personality to find expression. As technologies and human relations increase in complexity, however, the chances for individuals to develop unusual personalities increase, until we witness the rise of such world figures as Alexander the Great, Genghis Khan, Christ, and Buddha.

SUMMARY

Each individual must maintain a state of equilibrium if he is to continue living. In an environment in which the external stimuli remain constant, the action of the organism takes a constant rhythmic form, called spontaneous activity. The activity rate of an organism is modified by changes in temperature, etc., and also by interaction with other organisms. In the

face of such disturbances the hypothalamus, the autonomic, and the endocrine glands together maintain a constant internal environment, i.e., a state of equilibrium. This can be seen by the heart rate, respiration, etc. A disturbance in the external environment changes the rates of these organs, and when the disturbance is over the organism returns to its normal equilibrium.

The adjustment of the individual to others may also be defined as being in a state of equilibrium. If a person's relations with a second person are disturbed, compensatory changes take place in his relations to still others. Once the disturbance is over, however, he falls back into his habitual rates of interaction. In some cases the changes are severe or permanent, as when a member of the family dies, and such changes may cause a change in the individual's level of equilibrium, although each new state of equilibrium is a modification of a basic pattern which he developed early in life.

Groups of individuals, furthermore, also exhibit states of equilibrium. The individuals of whom a group is composed adjust their interaction rates to each other. As they separately attain equilibrium the group attains it likewise. Changes in the personnel of the group which affect the interaction rates of the members will, if they are not too severe, cause a readjustment at a different level of equilibrium.

Differences in types of personality possessed by individuals are responsible to a large extent for the nature of the equilibrium of groups. Personality depends on a combination of variables: (1) the amount of interaction which a person requires, (2) the frequency of his habitual interactions, (3) his origin-response ratio, (4) the rhythm of his interaction rate, and (5) his ability to synchronize, or adjust, to others. An individual's status in each of these variables is acquired by a combination of conditioning and genetic inheritance.

Extreme types of personality, which generally make it difficult or impossible for the individual to adjust in society, are called neurotic and psychotic. Psychotic persons in our society are usually put in insane asylums, while neurotics often lead secluded lives. Psychotics and neurotics can be distinguished from normal persons on a purely quantitative basis in terms of measurement of the five criteria mentioned above.

Among normal individuals, the most important type, from our standpoint, is that of the *leader,* a person who, when more than two other individuals are present, originates action in the majority of events, and to whose origins the others respond. A well-adjusted leader also responds in pair events when the others originate to him. Such a man can evoke loyalty and obedience from his followers. It is such men who play a major role in the development of institutions in societies.

PART II

Environment and Technology

CHAPTER 5

Terrestrial Environments [1]

I. INTRODUCTION: THE LANDSCAPE

In Part I we have just finished studying the ways in which the human organism adjusts to changes in the external environment and maintains itself in a constant physiological state, that is, a state of equilibrium. This external environment may be divided into two categories: (1) human beings, between whom interactions take place, and (2) external forces and objects to which the organism also has to adjust—the landscape, with its animals, plants, mineral substances, and climate. We have already seen how the organism adjusts to both categories of this external environment. We must now examine the way in which these two parts of the environment are interrelated, and determine the limits to which the landscape controls the relations between human beings. Before we can do this, we must describe the various environments of the earth, and the ways in which human beings have adjusted to them and built up, through conditioning, the habits which are the basis of our institutions, and which are responsible for the development of different types of personality.

The environments in which human beings live consist entirely of the surface of the earth, 72 percent of which is covered by water; only the remaining 28 percent is land. The oceans of the earth are continuous; animals equipped for travel by sea can go from any one spot to another. The land surface is, on the other hand, broken up into two major and thousands of minor isolated segments, and the movements of animals equipped for travel by land only are restricted.

That part of the *landscape,* or land surface of the earth, which has been unaltered by man, is known to geographers as the *fundament.* On much of the land surface of the earth, the fundament can no longer be observed; man has cut down the forests, drained the swamps, terraced the mountains,

[1] This chapter is based largely on *An Outline of Geography,* by Preston E. James, who has given his permission for this use of his work and has read the chapter in manuscript. The authors are indebted not only to Professor James but also to Ginn and Company, Boston, who published his book.

plowed up the grass, erected highways, fences, and buildings. But since man himself is a part of the landscape, so are his works. The landscape is just as "real," just as "natural," with man as without him.

Like other animals, man has been obliged to adjust his way of living to the landscape, to establish with it a state of equilibrium. Most wild animals encounter but a single type of landscape; man, as well as the animals which he has domesticated and taken with him in his migrations, has encountered and adjusted himself to almost all types. The types of landscape which human beings have encountered, and their varying contents, will now be considered.

II. TYPES OF ENVIRONMENT

The types of environment which comprise the land surface of the earth are not, in most cases, clearly bounded, so that a person might step out of one and into another, as in walking from the land into the water. Changes are usually gradual, and in passing from the most howling desert to the densest jungle, it is usually hard to tell when you have left one and entered the other. These changes are, for any part of the earth's surface, a matter of degree rather than of kind, and the differences between specific environments are the sum total of differences in the constituent elements which make up the environment. These include temperature, humidity, slope of land, and altitude, each of which varies on a definite scale.

The classification which we shall follow is that of James, who has divided the land surface of the earth into the following eight types, which are based on vegetation [2] and surface features. The first seven are based on vegetation with the surface features constant through the absence of mountains high enough to alter the vegetation type; in the eighth the surface features form the prime diagnostic.

A. The Dry Lands (Group I. James)
B. The Tropical Forest Lands (II)
C. The Mediterranean Scrub Forest Lands (III)
D. The Mid-Latitude Mixed Forest Lands (IV)
E. The Grasslands (V)
F. The Boreal Forest Lands (VI)
G. The Polar Lands (VII)
H. The Mountain Lands (VIII)

[2] Vegetation itself is a complex criterion, since it reflects temperature, rainfall, types of soil, and other criteria.

These divisions represent combinations of the constituent elements which cover wide areas. It is obvious that by using finer divisions on the various scales of the several elements, a finer classification could be made, and there are certain combinations which have been disregarded because the areas which they cover are too small, and for our purposes they are unimportant.

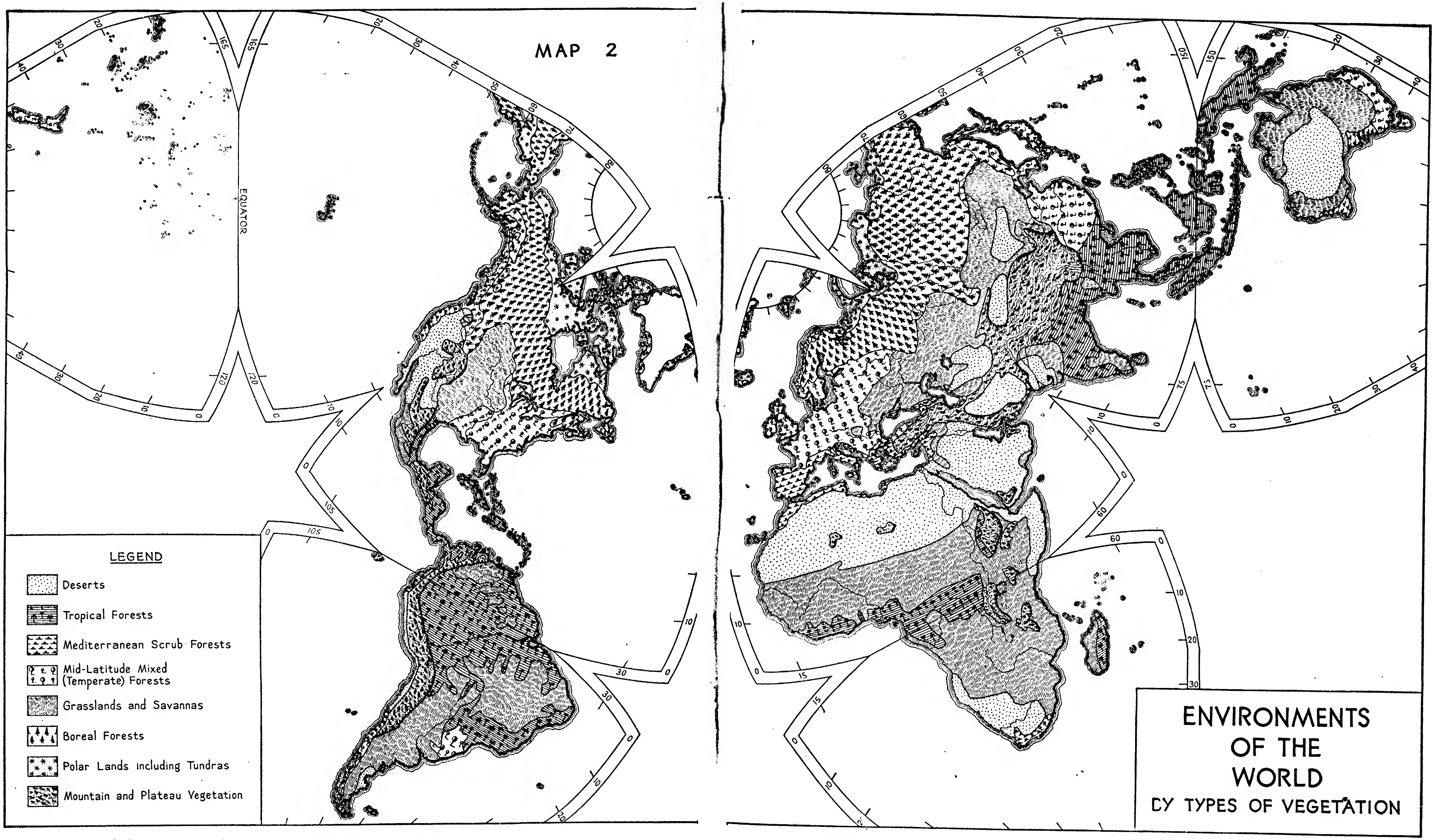
A. The Dry Lands. Dry Lands, or Deserts, are regions which have bare ground between the plants. As a rule they have less than ten inches of rainfall annually, reckoned at a mean temperature of 65° Fahrenheit. At a higher temperature they can have more rain and still be deserts, at a lower temperature, less. The balance between rainfall and evaporation is the important factor. In deserts, the rainfall varies from almost none to the limit specified above. Two places, the Libyan Desert in Italian Libya, and the Atacama Desert in Chile, are almost wholly rainless. Deserts like the main body of the Sahara and the Ruba el Khali in Arabia usually get some rainfall each year.

One of the most striking climatic features of deserts is the daily change in temperature; at In Salah Oasis in the Algerian Sahara, the temperature has been known to rise within twenty-four hours from 26° to 126° Fahrenheit. Ethnologists who have traveled with Australian hordes in central Australia tell the same story; the temperature falls from a high of 100° Fahrenheit in the middle of the day, to below freezing during the night. The natives, who are naked, can sleep with difficulty; most are huddled around their fires. Early in the morning, before sunrise, they get up and begin to move around. Their tempers are short and frequent quarrels arise, with some men throwing spears at each other. When the sun has risen clear of the horizon, they begin to quiet down; by noon the sun is beating unmercifully down upon them and everyone who can has found shelter.[3]

Not only is the daily range of temperature great in deserts, but also the world's highest temperatures are found there. The record is that of Azizia, Libya, with 136.4° Fahrenheit. This extreme heat of most deserts is a definite drawback to human occupancy. It is tolerable only because the air is very dry as well as hot.

Few deserts are entirely without vegetation, but all of them normally show patches of bare earth between the individual plants. Three types of plants are especially adapted to desert life: (a) *annuals,* which lie dormant between rains, and which grow and mature very rapidly when a rainfall comes; (b) *perennials,* with long roots; these are normally brown of leaf and stem, but they turn green and burst into flower when the rain falls;

[3] From oral account by Dr. N. B. Tindale, Adelaide Museum, Adelaide, Australia.



Of the many methods for the classification of climate, that of James, based largely on vegetation types, is most valuable for understanding the effect of environment on human relations. The present map differs from James's in projection, and omits many of his smaller areas of climatic distribution. As a further simplification we have designated as mountain climates only those regions in low and mid-latitudes which possess a variety of vegetation in conjunction with levels of altitude; i.e., those distinctive from the standpoint of human occupance.

(c) *water-storing plants,* such as cacti, aloes, and others with thick skins, thorns, and in some cases tough, hairy, or waxy leaves.

When it rains in the desert, the water is likely to come in the form of a cloudburst, causing great soil erosion and floods. What was once a barren waste is often carpeted with flowers and grasses over night, and the sweet smell of flowers is strong. Bees hasten to carry out their task of pollination before the plants wither, and unless it rains again soon, the desert becomes once more apparently lifeless.

Owing to the fact that all of the continents are wide at the north and taper to the south, and because all of them are equally affected by prevailing winds from constant directions, deserts are usually found on the west coasts of continents, between 20° and 30° latitude, either north or south of the equator. As they extend inward from the coasts, they also extend in the directions of the nearest poles.

There are five great desert areas in the world:

1. The African-Asiatic Drylands, stretching across the northern portion of Africa as the Sahara, then continuing on the other side of the Red Sea in Arabia, and up into Iran, Afghanistan and Baluchistan, and far into the interior of Asia. This immense tract of desiccated land, broken by seas and mountains into separate sections, is nevertheless, from the climatic and geographical standpoint, a single unit.

2. *The American Southwest.* This includes northern Mexico, especially the northwestern states of that country, and, in the United States, parts of California, Nevada, Arizona, New Mexico, Utah, and Colorado.

3. The South American Deserts. These extend along the Pacific Coast from northern Peru to the middle of Chile, and then cross the Andes to continue southwards in Patagonia.

4. The Kalahari Desert. This extends inward from the western coast of South Africa, and bends inward and southward.

5. The Australian Desert. This covers much of the Australian continent, but reaches the coast only to the west and south.

These deserts are examples, either singly or in combination, of two types of landscape: (a) the Mountain and Bolson type, with alluvial slopes and pediments at the feet of the mountains, and often with salt pans or salt lakes in the centers of the basins (the Great Salt Lake of Utah is an example of such a salt basin); (b) the Plateau and Dune type, which consists of great stretches of relatively level plateau, with patches of sand in the form of dunes. The Sahara, the Arabian deserts, the desert of northwestern India, the Kalahari, and the Australian desert, are mostly plateau and dune; the

great basin desert of the United States belongs to the first type, as do the South American deserts. In Central Asia, the Aral Sea and its surrounding flat lands form a huge basin, with the mountains of northern Iran and the Tian Shan acting as a rim. The Terim Basin of Chinese Turkestan is a similar giant basin.

Water in deserts, scant at best, may be obtained from four sources: (1) In the mountain and basin type, it is found at the feet of the talus slopes where the valleys or gullies in the mountains meet the basin surface. Here, wells and retaining dams may provide water, and here, settlements, if any, may be found. (2) Wadi Bottoms. In dry watercourses etched in plateaus, the ground water often lies close under the surface, and this water may be obtained by well digging. Hence strings of oases, watered by wells, may often be found along these dry watercourses. The Wed Draa in southern Morocco is a good example. (3) Artesian Wells. At certain places in deserts, the bedrock has cracked, or faulted, permitting the underlying water to seep up to the surface along the line of the crack. Thus natural oases are formed, as at Kharga, Farafra, Siwa, etc., in the Libyan Desert. (4) Exotic Streams. These are rivers that rise in well-watered highlands, and cross deserts on their way to the sea. They usually contain a greater volume of water where they enter deserts than where they leave them, if they leave them at all. Examples are the Nile; the Niger, the Hawash in Ethiopia, which never meets the sea; the Tigris-Euphrates; the Indus; and the Colorado.

Water in deserts, obtained from these four sources, is spottily distributed. Vegetable, and hence animal, life can be supported in abundance in a few places only. All of these places, whether talus slopes, wadi bottoms, artesian oases, or the banks of exotic streams, are classed by the geographers as "oases." Oases permit a sedentary human population of great intensity; the unwatered parts of the desert permit no sedentary life at all.

B. The Tropical Forest Lands (Group II). In striking contrast to deserts are the tropical forests, which occur in a belt less than 20° of latitude wide on either side of the equator, and which extend in the directions of the poles on the eastern sides of the continents. There are three chief areas of tropical forest: (1) The largest in the world is that of the Amazon-Orinoco basin in the Americas, which extends northward along the Atlantic coast to northern Mexico, and southward almost to the southern boundary of Brazil. (2) In Africa, the Congo basin forms the chief forest area, with extensions along the west coast as far as Liberia and Sierra Leone, and southward to Rhodesia. In general, the African forest is less dense than the

American. (3) The Southeast Asiatic forest includes much of peninsula and northeastern India, and the lowland regions of Burma, Thailand, Indo-China, and southern China. This extends also along the Malay Peninsula, and out into the islands of Indonesia, Melanesia, and Polynesia, and also along the northeastern edge of Australia, where a true rain forest is found in the region of Cairns. This third forest area is more insular than continental.

Geographers divide these tropical forests into two general types:

1. The Rain Forest. This type of forest has very many species of plants growing in close proximity to each other, over one hundred species to an acre being not uncommon. Here the surface of the earth is entirely covered with vegetation, caused by tall trees forming a continuous mat of leaves overhead. Down below, only trunks, lianas, and bare earth are visible in the dim light that seeps through. Animal life is rare on the ground, but more abundant in the trees, where it consists largely of birds, snakes, and arboreal mammals, such as monkeys. Only the rivers form passageways through this region of twilight. In the selva it rains every day, with showers in the morning and usually a downpour in the afternoon and evening. The trees are evergreen, and leaves, seeds, and fruits bud and ripen at all times of the year. There are no seasons, and the temperature is very constant. It usually ranges between 70° and 80° Fahrenheit, with an annual range of only about 3° in the monthly averages. The daily variation, about 15°, is much greater than the annual average variation, and it is felt by the naked peoples who inhabit the jungles because of the great humidity. True rain forests are limited to three principal areas: (1) the Amazon basin, (2) the Congo basin, and (3) New Guinea, some of the Pacific islands, and the Malay Peninsula.

2. The Semi-Deciduous Forest. This is the type of tropical forest found in regions where the rain comes seasonally. Here there is more space between the trees, and the ground is covered with undergrowth. This is a true *jungle,* very difficult to walk through. During the dry season, many of the trees lose their leaves, or turn brown. This type of forest is characteristic of the highlands of Brazil, the coast of Portuguese East Africa, most of Siam and Indo-China, and large parts of India.

C. The Mediterranean Scrub Forest Lands (Group III). In a few mid-latitude regions, between 30° and 40° N. or S. latitude, located on the coasts of continents, and on the poleward sides of deserts, are found scrub forest regions which have a peculiar combination of climatic features: a mild, rainy winter and a hot, dry summer. These regions are usually restricted in area by the proximity of mountains to the shoreline. Their vegetation is scrub

forest, mostly broadleaves[4] which are evergreen rather than deciduous, and at higher altitudes, a few conifers. Oaks are especially numerous in the roster of wild trees, and chestnuts also.

There are five main centers of Mediterranean climate, as follows: (1) the Mediterranean borderlands proper, from Portugal and Morocco to Palestine, on both the north and south shores of the Mediterranean and on the Atlantic; also parts of the Black Sea shoreline, especially the Crimea; (2) California and the northwest coast of North America, from Los Angeles to Vancouver Island; (3) middle Chile, from Coquimbo to Concepción; (4) a small area around Capetown, South Africa; (5) two small areas in Australia, one around Perth in the southwest, the other around Adelaide in the southeast.

D. The Mid-Latitude Mixed Forest Lands, or Temperate Forests, (Group IV). Three major regions of the world are characterized by a fundament which includes a covering of mixed broadleaf and coniferous forests, abundant rains, and a strong seasonal rhythm of winter and summer. When located near the sea, these regions possess a relatively mild climate; when near the centers of continents, they have a so-called "continental" climate, with greater seasonal extremes of temperature.

These three great regions are: (1) the United States east of the Mississippi and the St. Lawrence valley of Canada; (2) most of Europe north of the Mediterranean region, south of the boreal forest belt which crosses Finland and Russia, and east of the grasslands which lie north of the Black Sea; (3) most of China south and east of the Great Wall, and north of the tropical forest belt which stretches south of a line running from the region of Canton to Burma.

Besides the three great regions mentioned, patches of this forest may be found on the northwest coast of North America, in Chile and Tierra del Fuego, and in Australia, Tasmania, and New Zealand.

The mixed forest lands extend further north on the west than they do on the east coasts of the continents: England, Sweden, etc., lie as far north as Labrador, which is within the polar climatic zone. This asymmetry of temperature may be attributed to the Gulf Stream, which also keeps the annual temperature variation of western European countries at a minimum.

E. The Grasslands (Group V). Grasslands form a zone of transition between deserts and forests. Geographers divide them into four main types:

1. Steppes. These have a continuous cover of short grass, which grows

[4] A "broadleaf" is a class of tree which belongs to the angiosperm group, as contrasted with the "conifers," or gymnosperms. Both broadleaves and conifers include evergreen and deciduous species.

rapidly and remains brown during the periods of deficient rain. Steppes are found in eastern Russia and in Turkestan, in Manchuria and in parts of Mongolia, in North America in a north-south belt running from Texas to Canada, in a narrow strip of North Africa south of the Atlas Mountains, and in Patagonia. These steppes form the first zone of transition between deserts and the richer grasslands.

2. Prairies. Prairies are mid-latitude grasslands which are better watered than are steppes; they possess a deep, rich subsoil, the most fertile in the world, and one covered by long, wavy grasses, seven to ten feet in height. One of the principal soil characteristics of prairies is that, as a rule, the soil is black because of the deep accumulation of humus. On the dry margin of the prairie the soil is a chernozem, distinguished by the presence of limey accumulations in the lower layers. The chernozem is noted for its fertility, and is particularly advantageous for the cultivation of grains. Since the surface water is retained in the deep humus of prairie soils, a layer of dry earth extends between the humus and the underlying watertable. Where this dry layer is present, trees are unable to grow: therefore the borderline between forest and grassland follows, generally, the maximum extension of this layer.

There are two great, and one small, zones of prairies: (a) the American prairies, reaching from the eastern woodlands across the western half of the Mississippi drainage to where the steppes begin, in Nebraska, Kansas, and the Dakotas; and (b) the *chernozem* proper, or black earth belt, in Poland and southern Russia, mostly in the Ukraine, which is the granary of Europe. (c) The third, but smaller, zone is found in the Argentine humid pampa, Uruguay, and southern Brazil. (d) A still smaller zone is the region of Johannesburg, South Africa.

3. Savannas. Savannas are tropical grasslands, transitional zones between desert and forest in equatorial countries. There are three great savanna regions; in Africa, in South America, and in Northern Australia. None are found in the Eurasiatic land mass. These savannas are grassy plains dotted with trees, usually of the acacia-mimosa variety, and in the scale of increasingly arid climate they are one stage beyond that of the tropical scrub forests, with which they merge. Savannas in Africa are full of game, mostly of the antelope family, just as the North American prairies, before the arrival of the white man, were covered with bison. In savannas, as in all grasslands, there is usually a great seasonal change in vegetation and foliage; rivers crossing grasslands are likely to dry up and flood alternately.

4. The Tropical Scrub Forest. In regions where there is less rain than necessary to support a true rain forest or a jungle, one finds a zone of transi-

tion between the tropical forest and the grasslands. This is a scrub forest with a grass, or brush, floor, and a few species of small, thorny trees. These are all mimosas, of one kind or another; acacias in Africa, and mimosas proper in South America. Scrub forests of this type are found in Yucatan, where they greatly impede travel; in the Grand Chaco region of Paraguay, Argentine, and Bolivia; and in large sections of Rhodesia and Angola; and in portions of India. The tropical scrub forest and, to a lesser extent, the semi-deciduous forest, contain much more animal life than does the true rain forest. In this respect the semi-deciduous forest, or jungle, is intermediate. Tropical scrub forests are often difficult to differentiate from savannas.

F. The Boreal Forest Lands (Group VI). A belt of coniferous forests stretches around the northern hemisphere on the polar side of the line at which the monthly average temperature is 50° Fahrenheit for less than four months of the year. The reason for this is that most broadleaf trees will not grow in numbers north of this line. The conifers will grow both north and south of it; to the south they receive competition from the more efficient broadleaves and are found mostly in isolated enclaves. The northern limit of the boreal forest comes where 50° Fahrenheit is the average temperature for the warmest summer month.

The boreal forest contains few species of trees, in great contrast to the tropical forest. The commonest conifers in it are spruce, fir, and larch; the rare broadleaf forms that grow here are birch, beech, poplar, and willow. The fauna, however, is rich in species; the bear, moose, and caribou or reindeer are the three largest game animals, with the addition of the puma, or mountain lion, in America, and the tiger in Siberia. In both Eurasia and America carnivores and the weasel family, from the wolf and the wolverine down to the ermine, furnish an abundance of fur.

Rainfall is usually slight in the boreal regions, but owing to the low evaporation, it is effective. It comes mostly in summer; there is seldom deep snow in the boreal forest, except near the continental shore lines. The boreal forests are covered with lakes and rivers, so that an airplane cruising at 12,000 feet can find a landing place anywhere. This lacustrine groundform is due largely to the fact that many of the boreal regions, like certain small areas of the mid-latitude mixed forest lands, were covered by the last glacier. Another factor which contributes to the general wetness and swampiness of the boreal forest is the fact that in many places the subsoil is permanently frozen, and thus prevents the escape of water by infiltration.

In the boreal forests, summers are short, with long hours of sunlight each day; winters are long and dark. The trees do all their growing in the summer time, since vegetation will not grow at a temperature lower than

42.6° Fahrenheit. The temperature of the boreal zone reaches the world's greatest *annual* extremes, just as in the deserts it reaches its greatest daily range. Verkhoyansk, in northeastern Siberia,[5] has the world's record for cold, 93.6° Fahrenheit below zero, as well as the world's greatest temperature range, as the maximum recorded there is 93.5° above zero, making a total range of 187.1°. The mean annual monthly range runs from —58.2° in January to +59.9° in July, or 118.1°. Boreal forests are not eminently suited for occupancy by man.

G. The Polar Lands (Group VII). The polar lands include—as far as human habitation is concerned—the lands at the northern axis of the earth which fringe the borders of the Arctic Ocean in North America, Europe, Asia, and the islands of the Polar Sea; and, at the southern axis, the Antarctic continent. In the polar lands three types of landscape may be found: totally glaciated land, covered with a permanent ice cap; polar deserts; and tundras. Polar ice caps are confined to the Antarctic continent, Greenland. and parts of Ellsmere Island. They cannot be inhabited by man, and are of no concern to us here except as barriers. Polar deserts are those portions of the polar lands in which there is bare ground between patches of tundra. This is associated with the fact that in such places the mean temperature of the warmest month of the year drops below +41° Fahrenheit, and hence the land can support no vegetation.

The tundra is a zone of transition between the boreal forest and the polar deserts. At the edge of the boreal forest begins the *bush tundra,* swampy in summer, with the subsoil permanently frozen, and covered with a scrub vegetation of dwarf willows, birch, ash, and alder. Then comes the *grass tundra,* carpeted with sedges, mosses, lichens, and a few bushes growing close to the ground. Beyond this is the *desert tundra,* which is nothing but the polar desert border, where the desert surface is broken here and there by small oases of grass-tundra vegetation.

The polar lands are usually deficient in snowfall, and owing to their marine position, do not show as great annual variations in temperature as do the boreal lands. They have less vegetation, not because they are colder, but because they are less variable in temperature than the boreal lands. There is no summer in the polar lands sufficient to permit the growth of forest. Flowers, however, blossom rapidly during the short polar summer; their rapidity of growth and luxuriance of bloom remind one of the ephemeral luxuriance of the dry lands deserts of the low latitudes. The fauna

[5] Professor James informs us that the Soviet meteorological service has recently reported a still lower temperature, of —103° F., at a place called Oimikonski, in the neighborhood of Verkhoyansk.

of the polar regions, including fish, sea mammals, polar bears, arctic foxes, arctic hares, and birds, is very rich in the northern hemisphere; Antarctica boasts besides fish and whales only one wingless mosquito and the penguin.

Before leaving the subject of the polar lands, it is necessary to point out one fact: the climate of Tierra del Fuego, which some anthropologists have called polar, is not even boreal. It is a marine climate of high latitude, in which the warmest month averages below 50° and the coldest above 32° Fahrenheit. Although the mean annual temperature is low, no month is below freezing; trees can grow without difficulty, and the mountain core of the island is covered with a forest of tall antarctic beech. It is important that this point be made here, for the Fuegian territory was aboriginally inhabited by four tribes, the Ona, Haush, Yaghan, and Alikaluf, who practiced two of the world's simplest cultures, and who are often used as examples of the world's most primitive peoples. They do not, as some authors have erroneously stated, live in the same environment as the Eskimo.

H. The Mountain Lands (Group VIII). The climatic types of landscape which we have so far described are placed more or less symmetrically about the earth, their positions being primarily dependent upon latitude. If the surface of the land were all of the same height, matters would thus be simple. Altitude, however, forms a substitute for latitude; a mountain located on the equator, and rising to a height of 15,000 feet, reaches all the mean annual temperatures found between the equator and the poles. However, it is not possible to find all the *climates* on an equatorial mountain, because whatever the mean annual temperature may be, the monthly variation is slight. Thus climates which depend partly on variation for their characteristics are not typically found here.

As one ascends mountains near the equator, one finds, providing that there is sufficient rainfall, tropical forests on the lower slopes, mixed forests higher up, then a forest of conifers, and then alpine meadows above the tree line and below the snow line, with the snow cap on top of all. The coniferous forest corresponds to the boreal forest, the alpine meadows to the tundra. In wet regions, the tree line is low and the snow line low; in dry regions, the tree line is low and the snow line high. Thus the width of the alpine meadow zone depends on the amount of rainfall.

The most important fact from one standpoint about mountains, other than that they are barriers, is that they bring a variety of climates to all latitudes. The vertical zoning on their slopes is not, however, always regular; many factors arise to interfere. In all but low latitudes, one side of an east-west range gets more sunlight than the other. The dark side will have its vertical levels lower than those on the sunny side. One side is often wet,

the other dry; in high mountains, prevailing winds may drop their load of moisture on the windward side; in low mountains, the clouds that gather at the top may be blown to leeward and drop their rain there habitually.

There are three main chains of mountains on the earth, and their center of convergence is in the Hindu Kush. The three are: (1) the belt which runs westward across western Asia to the Balkans, the Alps, the mountains of North Africa, and the Pyrenees; (2) the great chain which borders the Pacific, running from Tibet in the north to the west of China, across Siberia to Bering Strait, and thence along the west coast of both Americas as the Rockies and the Andes; and (3) the partially submerged chain which extends southeastward through the Malay Peninsula to Sumatra, Java, New Guinea, and the island crest of Melanesia as far out as New Zealand.

III. ENVIRONMENT AND MAN

In the preceding sections of this chapter we have attempted to describe the environment in which man lives, and of which he himself forms a part. We have limited the description to the *fundament,* the environment as it is, or was, in various parts of the earth before, or without, the altering influence of human activities. It is now our purpose to describe (1) the *opportunities* within this environment which permit, or have permitted, various groups of men to develop their several types of civilization, and (2) the *limitations,* i.e., the environmental barriers which have had a restraining, or retarding, effect.

The human animal is a hairless, tropical primate, and is not comfortable in a temperature of much less than 70° Fahrenheit, without clothing. He is omnivorous, in that he eats both meat and vegetable matter, but he cannot eat grasses, and his vegetable diet is limited to fruits, seeds, roots or tubers, and a few kinds of succulent leaves. He normally requires food every day, and has no bodily storage facilities. If he goes more than two or three days without food, the results are serious. They are even more serious if he goes without water. Although he needs water every day, the amount required depends on the temperature and humidity of his environment, and on the nature of his activities.

The human animal without technical assistance cannot cross wide expanses of water, cannot stand much cold, and cannot seriously disturb the environmental equilibrium of plants or of other animals. The extent to which he can utilize various environments, therefore, depends upon the cultural equipment which he can bring into, or develop in, these environments. This qualification must be borne constantly in mind in the following

survey of the opportunities and barriers presented to human beings by the various types of environment.

1. Environmental Opportunities

A. The Dry Lands. The opportunities offered for human occupancy by the dry lands vary greatly with the part of the dry lands concerned. In completely waterless sections, as in the Libyan desert, this land is wholly unoccupied except by travelers following caravan routes and carrying their water with them. Even this traffic is limited. The deserts of normal vegetation, such as the Australian and Kalahari deserts, have just enough water, just enough root vegetables, and just enough animal life to support small populations of hunters and gatherers, who keep on the move most of the time and live just beyond the verge of starvation. Peoples with domestic animals which resist thirst, such as the camel, can live much more successfully on the deserts, but unless a high stage of culture has previously been reached in non-desert lands, no people can rise above the sparse hunting and gathering economic level in this environment. The most important limiting factor here is the scarcity of water.

Oases, however, present an entirely different problem, whether they be exotic river courses, natural artesian oases, wadi bottoms supplied by wells, or alluvial slope oases in the mountain and basin type of desert. These oases provide abundant water over a limited area. Hunting peoples find them useful not only as sources of drinking water, but as places in which to kill animals, for the animals must also drink. The vast herds of game about an African water hole form a picture familiar to almost everyone. Pastoralists, whose flocks must be watered, drive away the wild animals, and thus make life difficult for hunters. Agriculturalists grow rich crops on oases, since the soil, constantly watered, bears intensively and often yields several crops a year. In fact, an oasis will yield more food than its human occupants can consume, and hence an exchange between sedentary agriculturists and pastoralists becomes possible.

On the whole, the products which man may obtain from the dry lands are extremely variable in quality. The deserts themselves are, under most technological conditions, among the most difficult segments of the earth for human habitation; the oases, however, are extremely favorable, especially the banks of the exotic rivers;[6] the three highest civilizations of the Old World arose along the Nile, the Tigris-Euphrates, and the Indus. The dry lands occupy 17 percent of the land surface of the earth, and hold about 4

[6] See page 79.

percent of its present-day inhabitants. That 4 percent is largely concentrated, however, in the oases, which are, as the surface of the world goes, densely populated. In fact, the desert is a type of country *from which people come;* oases form a type *into which they go.*

B. The Tropical Forest Lands. Although the ancestors of man undoubtedly came in the first place from the tropical forests, they found far richer regions elsewhere. The rain forest provides little for pre-agricultural man: a few fruits and seeds, and very little game. The semi-deciduous forests, or jungles, have more game, but are very difficult to travel through, except by canoe. In all parts of the world where food gatherers live in rain forests or jungles, they are few, scattered, and exceedingly primitive in culture. The scrub forest regions are often rich in game, however, and are usually more densely peopled. For simple agriculturalists, the tropical forests offer little; the soil is poor and clearings are hard to make. Once made, they soon become overgrown. Only by intensive agriculture, in which the entire vegetable covering of the fundament is removed and kept clear—and in which rice is a staple—can tropical forests support large populations. Examples of this type of region are Thailand, Java, parts of Sumatra, parts of Luzon, and elsewhere in the East Indies; in fact Java has one of the world's densest populations. On the whole, the tropical forests are relatively thickly peopled, since they cover 13 percent of the land area of the earth, and hold 27 percent of its population. This high figure, however, is almost entirely due to the large populations of India, Java, and the Philippines. If the tropical forests of South America and Africa were reckoned separately, the figure would be quite different. The conclusion is that while the tropical forest provides no difficulty for the human organism in respect to temperature and drinking water, it supplies insufficient food, except with the use of advanced agricultural techniques.

C. The Mediterranean Scrub Forest Lands. The Mediterranean landscapes, although small in area, will support relatively dense populations, even at the lowest stages of culture. Forests of oak and chestnut provide ample supplies of starchy food, once the acorns and nuts are leached in water to remove the bitterness and poison; wild fruits abound, and there is plenty of small game. California, which has a Mediterranean climate and was peopled in pre-Columbian times by men in a food-gathering stage of civilization, supported a relatively dense population before the arrival of the Spaniards. The portions of Australia which enjoy a Mediterranean climate were likewise the most densely populated parts of that continent in aboriginal times. In the Mediterranean basin proper, civilization of a high order is old, but the archaeologists inform us that in post-glacial times, before the

introduction of agriculture, the population was also relatively dense. The Mediterranean climate is not too cold for people with only the most primitive methods of conserving bodily heat, and provides ample food and sufficient water. It was without question one of the most easily exploited types of climate available to early man, and this is true whether the occupants are food gatherers, farmers, or people living at some other stage of civilization. With only 1 percent of the world's land area, the Mediterranean climatic regions hold 5 percent of its population.

D. The Mid-Latitude Mixed Forest Lands. The climatic group which today holds 53 percent of the earth's inhabitants and occupies only 7 percent of its land area, has attained its position as an area suited for complex civilization only within historic times. The mixed forest lands of mid-latitudes, in Europe and Asia, were looked upon by the Greeks as too cold and inhospitable for human occupancy, and were avoided by the highly civilized peoples of the Near East in antiquity. Only in Roman times, with the conquest of Gaul, Britain, and the Rhinelands, were they opened up to extensive settlement. In China, even, the settlement of similar regions by a dense agricultural population was a very gradual process, and in North America at the time of Columbus, these forest regions were thinly populated in comparison with Mexico and the highlands of South America.

The mid-latitude forests provide moderately abundant game, little natural vegetable food, but plenty of water. They are too cold for men to live in comfort without advanced techniques of producing food and providing shelter, and the forest cover cannot be removed for extensive agriculture without good tools. The plants and domestic animals necessary for an efficient exploitation of these lands were all native to other regions, and had to be developed before they could be introduced. Once they were brought in, however, these lands underwent a greater transformation at the hand of man than the lands of any other category. In China in particular, it is difficult to find traces of the original forest cover.

These lands, in summary, are the best of all for human living on an advanced scale of exploitation. That is why they were settled intensively only at a late date. As for pre-agricultural man, they can support only thin populations of hunters, who are adapted culturally to the preservation of bodily heat through severe winters. The game is not plentiful enough to allow such a group to become sizable. Primitive agriculturalists in these regions cannot live much more densely than can the hunters.

E. The Grasslands. In discussing the occupancy of the grasslands, which cover 19 percent of the earth's surface and hold 6 per cent of its population, we must be careful to distinguish between the mid-latitude grasslands (i.e.,

the prairies and steppes) and those in the low latitudes (i.e., the savannas). Prairies and steppes, before the introduction of agriculture and domestic animals, are thinly populated by groups of hunters; with the introduction of domestic animals the population increases enormously. With the horse, plainsmen can hunt the wild ruminant game, as did the Indians on the American plains; with cattle and sheep, they can live off the products of their flocks, as do the nomadic peoples of Central Asia. With modern agricultural machinery, they can turn the prairies into the richest grain lands in the world, for the deep, moist, stoneless, lime-filled topsoil of the American prairies, and of the chernozem belt in Russia, are without equal. They are not suited to primitive agricultural methods, and their intensive utilization dates only from the period of modern agricultural machinery. The mid-latitude grasslands were even less favorable to primitive men than the mid-latitude forests, owing to the fact that water can normally be obtained only along rivers.

The savannas, on the other hand, are more suited to primitive human life. In Africa, both animal husbandry and agriculture are practiced on them by tribes of Negroes and Negroids, while the game supply remains great and hunting is a profitable enterprise. In South America, the lack of domestic animals made the full utilization of these lands less profitable, and hence, the savannas of the Brazilian highlands were largely occupied by sparsely settled groups of semi-nomadic food gatherers.

On the whole, mid-latitude grasslands are unfavorable for food gatherers without domestic animals for transportation at least; tropical grasslands are better, owing to their large game supply. It was from the tropical savannas that the once numerous hunters of South Africa were pushed by pastoral peoples into the Kalahari desert. Like the mid-latitude forests, grasslands require the introduction of materials and techniques developed elsewhere, if they are to be effectively utilized.

F. The Boreal Forest Lands. The boreal forests of the north provide one of the least useful climatic areas for man at any stage of culture. With 9 percent of total land area, they hold, even today, but 1 percent of the earth's population. It is too cold for people to live there without excellent garments and adequate housing; a considerable cultural advance was necessary before this region could be occupied at all. Once there, however, this advance was retarded by the lack of materials and opportunities. Agriculture is impossible in most of the boreal forest, and except for berries in the summer, there is no vegetable food of consequence. The inhabitants of such regions must by necessity be hunters. The domestication of the dog in all boreal areas, and of the reindeer in Eurasia only, has improved the lot of the

inhabitants somewhat, but not much. Modern exploitation has taken three major forms—trading furs with the native inhabitants for such products of modern civilization as traps, guns, cloth, and flour; exploiting minerals; and felling softwood logs in great quantities for the manufacture of paper. The boreal forest is still a frontier region. It has not yet been fully developed commercially. With the airplane available for rapid transport, it will probably grow in importance in the near future.

G. The Polar Lands. The tundra and polar deserts hold less than 50,000 inhabitants all together, although they cover 16 percent of the land surface of the earth. The greater part of this area is included in the Antarctic continent, occupied only intermittently by parties of explorers, who take all of their food with them. The north polar region, however, offers a rich harvest of fish and of sea mammals to those clever enough to reap it. From the Chukchi Peninsula in Siberia to the east coast of Greenland, only one people has ever qualified in this respect; these are the Eskimos. Aside from the maritime Chukchi, and the maritime Koryak, who live with the Siberian Eskimo on the Asiatic side of Bering Strait, the Eskimos are the only polar people, and polar civilization is a single cultural unit.

H. The Mountain Lands. The opportunities which the mountain lands offer for human occupancy depend largely on the locations of the mountains. Polar and boreal mountains offer little or nothing of advantage; mountains in temperate lands may offer minerals or timber, or even pasture. In some places, as in Switzerland, mountain peoples move up and down the slopes performing different activities each season: in the spring they plant gardens part way up, in the summer they graze cattle and make cheese and butter on the higher alpine meadows, while in the winter they spend most of their time in the valleys.

The mountainous environment, in regions of low latitude, offers the greatest opportunities for human exploitation. In Central and South America, mountain slopes and plateaus provide areas of moderate temperature and rainfall, with little annual variation, which are ideal for the development of intensive agriculture. These mountains are furthermore the source of much metal. Plants suitable for domestication were abundant in the Andean area, as was the single American domestic animal of economic importance, the llama.

Similarly, in the Old World, the mountains of Afghanistan, Iran, Syria, and Asia Minor are the home of many species of domesticable plants and animals; conditions for agriculture are also excellent there. Mountain climates in low, or low-medium, latitudes provide the maximum opportunity for the initial development of complex human civilizations, and after them

come dry land oases and Mediterranean climatic regions. In these three groups of climate, the temperature problem is not serious, while utilizable species of animal and plant life are, in certain areas, abundant. More northerly forest and grasslands, rich in minerals and in soil, could only be utilized after the primary advances had been made in the key climatic areas mentioned.

2. ENVIRONMENTAL BARRIERS

Variations in the landscape, besides offering man correspondingly varied opportunities for the utilization of his environment, present another problem as well—that of relative difficulty, or ease, of transportation and communication. Some features of the earth's surface offer barriers, while others are natural highroads. Some features which are barriers at one stage of culture may be highroads at another. The degree to which these phenomena affect man depend upon his level of attainment in mastering the forces of his environment.

The most obvious barriers to human circulation are the oceans. Early man, at the beginning of his cultural experience, could traverse them no farther than he could swim, which was not far. To cross such bodies of water as the Straits of Magellan, the Straits of Gibraltar, the Irish Sea, and the Bering Strait, would be impossible without some form of boat, providing that these bodies of water took their present form. Indeed, Gibraltar was long a barrier to man, as the archaeological record makes clear; Ireland was uninhabited before post-Glacial times, and America was not invaded until people had learned the techniques of simple boatmaking.

With the development of navigation, however, the seas became increasingly less a series of barriers, and more and more a set of interconnected highways. Without the seas for highways, the British Empire could never have risen; without them, the islands of the Pacific would never have been settled, nor America discovered. Inland waterways, rivers and lakes, have long served as highways to people living in the temperate and boreal forests of much of the world, especially in those forests unexploited by agriculturalists.

Another important set of barriers is furnished by deserts. Some of these, such as the Ruba' el Khali in Arabia, are for all practical purposes impassable. Others, such as the Sahara, have enough water located at strategic places to permit the passage of caravans of donkeys and camels along well-defined routes. The passage of these caravans furnishes an added economic impetus to the life of the people dwelling in oases. On the whole, the deserts are still important barriers, and presumably will be for a long time to come. With

the automobile and caterpillar car, however, and with the airplane, they can be crossed with impunity, and may be opened up for mineral exploitation, as has been done in the eastern part of Arabia by the Standard Oil Company of California.

A third set of barriers is that of forests. Huge, dense, primeval forests, in both tropical and mid-latitude lands, serve as real barriers of great effectiveness. In the South American rain forest, this barrier has been strong enough to prevent primitive tribes of Indians from extinction or assimilation by white men; the Hercynian forest in Bavaria and Bohemia was an important barrier to the movement and settlement of peoples in Roman times. The boreal forests of Canada and Siberia have proved equally effective barriers. Huge forests, no matter what the economic value of the soil upon which they grow, cannot be utilized by man until he has perfected his techniques of civilization elsewhere. It is noteworthy, however, that in the history of the exploration and settlement of the United States the mid-latitude forest served as a highway to the pioneers of English extraction, since it provided the materials for fuel, food, and shelter, whereas the prairie was a barrier. To the Portuguese in Brazil the forest was a barrier, and they cut across the narrowest part of it when making their route to São Paulo. The forests of Chile were a definite barrier also to the Spaniards, and offered the Araucanian Indians a shelter for many years.

A fourth barrier is that of mountains, which often served to separate zones of climate and to keep men from passing from one region to another freely. Italy, for example, is hemmed in on the north by mountains. Only a few passes, of which the most important is the Brenner, permit overland access to the peninsula. The greatest mountain barrier of all, however, is the Himalayan mountain chain. For millennia it has protected India from the north, and sharply delimited zones of race and of civilization. Invasions which have entered India from outside have almost uniformly come over a series of three passes, the last of which is the Khyber, from the region of Russian Turkestan via Afghanistan. The last and greatest invasion of India, that by the British, came by sea.

Mountains may also, however, serve as highways, in that by traveling along them at a uniform altitude people can keep within specified climatic zones, and thus can continue to use the techniques which they had developed in another area under similar environmental conditions. This is particularly true in Southeastern Asia and in Central and South America, where the lowlands are jungles in certain places, and the highlands relatively free from the barrier of excessive vegetation.

Barriers, when effective, create what is known as *refuge areas.* A refuge

area is a region in which animal and vegetable species, and man as well, are protected by barriers from competition, and in which change comes less rapidly than in regions of greater circulation. For example, Australia has been separated from the Asiatic land mass by a water barrier for millions of years. Until the white man came, her mammalian fauna was extremely archaic, since it was limited, except for man and the dog, to marsupials, animals which had long since yielded to more complex evolutionary forms in every other continent. The inhabitants of Australia, furthermore, were all Stone Age food gatherers until the time of European settlement. Tierra del Fuego is another excellent example of a refuge area, isolated by land distance, by oceans, and climate from most of the habitable world. Its inhabitants serve as striking examples of culturally retarded peoples. Tibet is another refuge area, both racially, for it contains a great variety of archaic human forms, and culturally. Ireland is a refuge area, in that it is one of the last places in Europe where Celtic speech survives, and in that some of its inhabitants were using stone tools up until the time of Christ. Another excellent example is the Caucasus, where people wearing chain mail and speaking archaic remnants of formerly great language groups still maintain their medieval methods of living almost unchanged.

The opposite of refuge areas are regions in which circulation is easy and a maximum amount of interaction is possible. Oases, for example, are centers toward which people gravitate, and from which products and ideas are spread; rivers are often avenues of travel, and river mouths ideal places at which to meet numbers of people. Mountain passes are much more frequented than mountain peaks; the shores of natural harbors are more likely to have large populations than bleak headlands.

Hence the *spatial position* of human occupation is largely determined by environment in terms of the technology of the people concerned. The density of the population depends on the amount of food and water available for the people at the level of technical adjustment at which they find themselves. This level may itself depend upon the ease or difficulty with which ideas can be disseminated to a refuge area from a center of development. Special centers of population are usually located at easily accessible places; the Boy Scout who, when lost in the Maine woods, repeated to himself: "Find water and follow it downstream. All rivers lead to civilization," was following an almost fool-proof principle of human geography.

SUMMARY

Before we can study the ways in which individuals and groups of individuals make their adjustments with the non-human parts of the external

environment, we must see accurately what this environment is like. Our environment is the surface of the earth, 72 percent of which is water. The *landscape* is the land surface of the earth, the *fundament* is the landscape without human alteration. The degree to which man has altered the fundament reflects the complexity of his adjustment to it.

Types of landscape may be classified on the basis of a number of variables, such as mean annual temperature, the annual temperature range, the amount of rainfall each year, the monthly distribution of rainfall, the altitude, and the regularity of surface configuration. Two are most useful for our purpose, vegetation, which reflects the balance of the other factors mentioned, and the surface configuration. Following James, we recognize eight principal types of landscape. These are Dry Lands, Tropical Forests, Mediterranean Scrub Forests, Mid-Latitude Mixed Forests, Grasslands, Boreal Forests, Polar Lands, and Mountain Lands. Each of these offers different opportunities and imposes different limitations to man for his exploitation in terms of the techniques at his disposal. What is easy to exploit with one set of techniques will often be difficult with another.

Mountain environments in low or low-medium latitudes provide the maximum opportunity for the initial development of complex human civilizations, and after them come desert oases and Mediterranean Scrub Forests. In certain of these climatic areas in the world plant and animal species suitable for domestication are abundant, and the temperature is not low enough to make necessary elaborate techniques of providing bodily covering and shelter. Regions situated nearer the poles can only be utilized with equal effectiveness after the primary advances have been made elsewhere.

Some features of the landscape are barriers at certain stages of technology. This is true of deserts, mountains, forests, and polar lands. With advances in techniques some of them cease to be barriers. The same is true of the ocean, lakes, and rivers, which, with the invention of shipping, become highways. Areas protected by barriers are refuge areas, in which people may retain simple techniques until other people with more advanced techniques arrive there. Regions which lie along natural highways usually become centers of civilization as soon as adequate techniques have been provided. The spatial position of human occupation of the earth's surface is largely determined by environment in terms of technology.

CHAPTER 6

The Techniques of Manufacturing

I. CUTTING TOOLS

In the last chapter we reviewed the basic kinds of environment which together make up the land surface of the earth, that is, the fundament, on which man lives. We are now able to study the techniques by which he is able to adjust himself to each of these several environments, and in so doing to carry on interaction with his fellow men. At the same time, we shall consider how the technical processes which people have devised have enabled them to develop the complex types of adjustment which make up the different cultures, or civilizations, of the world.

Fundamentally, all of these civilizations, from the simple subsistence adaptation of a Bushman, or Australian aborigine, to the complex industrial existence of modern Americans, are based upon the possession of tools. In fact, as we shall see presently, this is the fundamental factor which enables man to modify his environment, and finally to create, within limits, an environment of his own; through such mechanisms as skyscrapers, glass-walled conservatories, air-conditioning machinery, and central heating systems. But of all man's tools, the most fundamental are cutting tools, the basic machine tools of which we hear so much today. With these cutting tools he can make weapons with which to kill animals for food; he can make hoes, plows, rakes, and other agricultural machinery; he can also make secondary tools and machines, such as looms and milling stones; and he can make vehicles of transportation, such as chariots and canoes. In other words, with cutting tools he can make all types of material objects, and therefore his basic methods of acquiring materials, as well as of processing them, are dependent on the type of cutting tools which he is able to use. Our whole modern industrial technology is dependent upon machine tools, to which we pay little attention in ordinary times. In times of national crisis, however, when the activities of an entire nation are geared to the production of materials of war, it soon becomes clear that the rate of speed at which armament can be produced depends on the number and efficiency of these tools available to arms manufacturers.

A. Flint Tools. The simplest and most primitive effective primary tools are made of flint, obsidian, quartzite, or other varieties of siliceous stone. The cutting edge of a piece of broken flint is like that of broken glass; it is as penetrating as steel, but it chips and flakes readily with use, which is a disadvantage. People who use flint for primary tools devise standard ways of shaping their material for effective use; those who practice advanced techniques of flint-chipping, as, for example, the Australian aborigines, can make over a dozen separate styles of finely shaped blades, specialized for use as knives, hide-fleshers, spokeshaves, bone-etchers, and other purposes. People whose only basic tools are chipped flint implements, no matter how finely formed or varied, cannot seriously alter their landscapes, since they cannot cut down large trees or dig deeply into the surface of the earth, nor can they, with inferior weapons, exterminate fish and game.

Shell, Fish-teeth, and Bamboo. In several of the tropical forest regions of the world, people living in places where flint is unobtainable have developed a number of substitutes of about the same level of efficiency. These include the shells of bivalve molluscs, such as clams, which can be used to cut meat and fruits; the teeth of carnivorous tropical fish, such as the barracuda, which can be used in wood-cutting, and are nearly as hard as flint while much less fragile; and slivers of bamboo, which has a large amount of silica in its surface layer, and hence is good for cutting meat and other substances of similar consistency. The Choroti tribe in the Grand Chaco region of South America will serve as an example of a people with no cutting tools whatever, aside from shell, fish-teeth, and bamboo; the environment in which they live is a flat, alluvial plain, flooded once a year and completely lacking in stones. The relation between their environment and their basic technology is therefore clear.

B. Polished Stone Tools. The first great advance in the manufacture of cutting tools, beyond flint, bamboo splints, and fish-teeth, comes with the invention of the polished stone ax, which, unlike the more fragile implements just mentioned, can be used for heavy work such as chopping down trees. Here a new principle is involved: that of pecking a pebble or other piece of fine-grained stone—preferably not flint—into the form of a heavy wedge, with one pointed edge set at right angles to the main axis of the stone. The next step is to polish the edge, if not the entire tool, so as to give a fine, smooth cutting surface. The ax-head is hafted in a handle, and the man equipped with this ax can fell trees. With the wood so obtained, he can build good houses, hew canoes, and even, as in Polynesia, build large sailing ships. What is even more important, by felling or limbing

trees, he can clear the ground for the cultivation of crops, the importance of which we shall see in our discussion of tropical systems of agriculture. In regions where good, fine-grained stone is scarce or unobtainable, as in the coral islands of Micronesia and Polynesia, it is customary to use the shell of the *tridacna,* or giant clam, instead. The outer surface of this shell is marked with parallel growth ridges, and the edge of each ridge is harder than the rest of the shell; the ax-grinder takes advantage of this and makes the ridge edge serve as the edge of his adze.

People who use stone or shell axes for felling and hewing wood, also retain chipped implements of flint or obsidian for other purposes, such as skinning animals and cutting meat, to which they are well suited.

C. Metal. The second great advance in the technique of tool-making comes with the smelting of metal and the manufacture of metal tools. Metal differs from flint and stone in several ways. In the first place it is not as fragile; metal will bend or nick, but it can be hammered back into shape again, and this is not true of flint or stone. Furthermore, metal is a plastic; it can be heated, melted, and beaten or poured into any shape desired. When a metal tool has passed its stage of first usefulness, it can be reheated and used over and over again.

The variety of forms possible with a plastic is much greater than with a material such as stone, which must be shaped by chipping or grinding only, and which is easily broken. Furthermore, the sizes of the objects made from metal do not depend on the sizes of any units of material, since many pieces of metal may be combined to make one object. Finally, anyone can recognize raw flint or stone suitable for tools. It requires, however, specialized knowledge to recognize most metal ores, which usually differ in appearance from the metals which may be derived from them.

Metal ores occur in only a few places. Flint and usable stone are more abundant. This means that people who extract, process, and use metal must engage in more trading activities than people who use flint and stone. The processing of metal is a difficult operation which requires much skill, acquired only through a long period of conditioning, a lengthy apprenticeship; the worker in metals is a skilled technician, and hence usually a full or part-time specialist.

Flint and stone have limited uses. Flint can be used only for cutting tools and producing fire.[1] The technique of polishing stone can be applied to few types of objects other than axes and adzes; these include hammers, mace-heads, clubs, and a few simple ornaments. Metal, however, may be

[1] By the flint and steel, or flint and pyrites method.

made not only into cutting tools, but also into many kinds of objects, such as rivets, nails, pipes, axles, propeller shafts, ship hulls, tanks and machine guns. The extent to which metal is used, that is, the per capita consumption of metal, increases directly with the complexity of human adaptations to the environment, and with the complexity of human relations.

Metal is, therefore, the most widely traded and most highly valued of all commonly used commodities, and this has apparently been true as long as people have known how to smelt it. Many hunters, farmers, and animal breeders import metals in the form of manufactured tools, blooms or ingots, though these people get little else from the outside world. Not every smith who knows how to cast bronze or forge iron is acquainted with the techniques of smelting, by which the metal is reduced from the ore; this is done in relatively few places and by few individuals, since it is only in scattered spots that mineral ores are mined, and the products of smelting the ore are so compact that they can be cast into portable units.

Smelting. In order to melt copper, it is necessary to get a fire as hot as 2192° Fahrenheit. Ordinarily this cannot be done with a wood fire or without a forced draft; hence most people who practice smelting use charcoal and pump air into the fire with bellows. The melted copper which runs out of the furnace can be remelted in a crucible, and cast into convenient shapes, or directly into the implements desired. In order to smelt copper, therefore, it is necessary to have the ore, a furnace, a bellows, and charcoal. Different metals fuse at different temperatures, but most of them can be reduced by the same general technique as copper. Lead, however, must be smelted in a covered furnace, for lead ore will otherwise turn directly to a gaseous state and disappear.[2]

In smelting iron, the idea is not to melt it so that it can be poured or cast, but to reduce it to a soft, spongy mass which can be forged, since cast iron is brittle and cannot be used as material for cutting tools. In Negro Africa, where much iron is smelted under primitive conditions, the smelters use both hematite, which they mine in the forest, and magnetite, which they pan out of stream beds. They place charcoal in a hearth and put the ore on top of it, or else they place the ore between layers of charcoal. With the use of pump bellows, they burn this under a forced draft for several hours. The iron does not melt, but grows soft and oozes out onto the ground, forming a "bloom," which can later be forged into tools.

The primitive smith requires as his tool-kit only a stone anvil, which may be merely an unshaped stone, a hammer, which may be of iron or of

[2] Childe, V. G., *Man Makes Himself*, London, 1936, pp. 130-133.

stone, and a pair of tongs. On this anvil he hammers the bloom, removing the slag, and breaking it up into pieces of convenient shape and size.

Smelters who use more advanced techniques do not need bellows. In two areas in Negro Africa, one in Nigeria and the other in the Zambezi River country of East Africa, they build furnaces with high chimneys, which create a draft sufficient to produce a high temperature. These same smelters also add a flux, of limestone, quartz, or shell, to the ore, to liquefy the slag and release more of the iron, thus making the process less wasteful.

At the beginning of the modern industrial revolution, it still was the practice to smelt iron with charcoal, and in England such was the demand for iron that charcoal became scarce and many forests were cut down, particularly in Ireland, to supply the demand. However, it was eventually discovered that coke, or coal from which the gas has been extracted by heating, would do equally well, and this stimulated the exploitation of the coal mines of Wales and also those of Lorraine. The process of smelting takes more fuel than it does ore; consequently, people who use coke for smelting transport the ore to the coal regions instead of doing the reverse. However, the peoples of the world who still practice simple smelting techniques and who consume little metal, can usually obtain the fuel which they need locally.

Casting. The simplest technique of casting metal is to shape an open mold into the desired form and pour the molten metal in. By this process, one side of the object so produced necessarily remains flat; this is good enough for simple ax-blades, but a much better technique is to make a two-piece mold with the parts lashed together. Such molds can be used over and over again, and can be operated rapidly, permitting mass production. A more involved technique is *cire perdue* (lost wax) casting, in which the metallurgist makes a replica in wax of the object which he wishes to cast, and covers this replica with clay, leaving a hole for pouring and one or more other holes to let out the wax. He then bakes the clay, and, by so doing, melts the wax, which flows out; the next step is to pour in the molten metal, and when it is hard, to break away the clay matrix. This technique does not permit mass production, but it does permit the manufacture of objects of complex shapes with many surfaces oriented in different directions.

Alloying. Copper was historically the first metal used for tool-making, in both the Old World and the New. Copper is not a very hard metal, and it is difficult to cast; bronze, a mixture of copper and tin, is much better in both these respects. Hence in both hemispheres, there was a period in which metallurgists used first copper, and then a blend of these metals. At

first, the proportions of copper and tin were variable, but at length a stable ratio of about 10 to 1 was found to be best, and was more or less uniformly followed.

People who use simple hand methods of smelting and casting metals make relatively few kinds of alloys and use relatively few metals; copper, tin, lead, iron, and gold are the commonest. Modern metallurgists, however, are able to produce a large number of alloys by using such elements as aluminum, molybdenum, manganese, and beryllium which cannot be extracted by primitive methods, and which widely extend the variety of objects which may be manufactured with cutting tools.

In tool-making, as in all other human endeavors, the progression from the simplest culture to modern civilization has been one of increasing specialization, and of increasing complexity of human relations, with more and more people involved in the production and use of a single object, and with the materials from which this object is made traveling longer and longer distances from their native sources to the hands of the consumer. This principle of specialization reaches its maximum in the relationship between the modern Occidental and the more primitive worlds. Every Indian in Canada uses steel axes and knives, but not one of them could make a single metal cutting blade.

D. Tool-Making and the Processing of Tool Materials. The Australian or Fuegian who chips flint or glass into tools does so when he needs the tool for use. The man who pecks and polishes a pebble into an ax also does this for use, or for trade. Instances of a trade in raw flint, or in raw ax-stone, are relatively rare. However, in the case of metal, the two steps of the preparation of a staple and of the manufacture of the finished object are often separated. The number of men who smelt copper, iron, and other metals is relatively small; the number of men who cast or forge tools is relatively great. It is a common practice to trade ingots, or bars of metal, from the place of origin to the point of consumption, and this practice becomes increasingly prevalent with the increasing use of metal. As we shall see in our study of other processing techniques, people who live on a subsistence level of adjustment rarely process materials of any kind very long before they need to use them, while people who practice extensive trade often convert their materials into easily transported and negotiable units.

The manufacture of simple metal tools, therefore, by the techniques of smelting and casting is, as we have seen, a technical feat of some complexity. Few people know where to find deposits of copper or tin, or how to recognize these minerals when they see the ores. Few know how to extract the metal from the ore, how to blend two ingredients, or how to cast tools.

With the historical advent of bronze tools, a considerable specialization of labor, a wide exploration of distant areas, and wide trade became necessary. Many different persons, even different peoples, had to cooperate before a bronze tool could be made. Furthermore, for each person who made tools, there were probably several hundreds who used them.

The same principle applied to the working of iron. Although the ores are commoner than those of copper and tin, nevertheless the iron worker's trade is a complex one, and the number of persons engaged in smelting in any area at any one time is undoubtedly small. In Negro Africa today, where every village has a blacksmith shaping tools on his anvil, there are many whole tribes who get all of their raw iron from outside by trade. This is even more true of the modern world; for every person in the United States who makes tools, there are thousands who use them and would be incapable of making them if the need should arise.

E. Tool-Making and Wood-Processing. The techniques of tool-making are also directly related to those of processing wood for use. People who have only chipped flint cutting tools cannot ordinarily fell trees; they can use for their wood-working only saplings, branches, and trunks which have fallen naturally. They cannot, furthermore, fashion the wood so obtained into very elaborate objects. Spears, bows, shields, and crude shelters are about the only things that they can make with it. The process of cutting wood is laborious; scraping is about the only technique which they can use, and sawing is out of the question.

People who have axes and adzes, however, can fell trees and square the logs into beams, and can also split them into planks; they can adze these planks into good lumber, even if the axes and adzes are made of stone or shell only. With the additional help of chisels and mauls, they can make good ships, houses, and such implements as plows. People like the Polynesians and the Northwest Coast Indians were expert carpenters and shipwrights. With metal tools comes the use of saws, planes, augers, and the other implements in the modern carpenter's and cabinetmaker's toolboxes and a consequent increase of speed and efficiency in woodworking.

Most people who live on a simple level of adjustment do not fell trees or prepare lumber before they have use for it; furthermore, the man who cuts the tree down usually uses the wood himself. It is only in elaborate civilizations that one finds people sawing out boards for sale, without knowing what they are to be used for, and this is seldom done where the woodworking is a purely hand technique: the power-driven circular saw, planing machinery and related devices are necessary for commercial lumber-processing.

F. Tool-Making and Fire-Making. Aside from tool-making, one of the most basic techniques known to man is fire-making. Fire is used, as we have seen, in processing metal; it is also essential in processing food, and in keeping the human body at a constant temperature. Human beings could conceivably live without fire, since many foods can be eaten raw, and some environments are warm enough without fire, but fire is necessary if human civilization is to attain any degree of complexity, and, as far as we know, people have used fire as long as they have made tools.

Although all people use fire, all do not know how to make it; a few, including the Andamanese, have to keep it going constantly, since if it were to go out, they would not be able to kindle it again. It is not known whether the Andamanese once knew how to make it and forgot, or obtained it originally from some natural source, such as a volcano, or a forest fire started by lightning. It is quite possible that the earliest use of fire antedated the knowledge of the techniques of fire-making.

These techniques are dependent, like all others, on the use of cutting tools. The commonest methods are those which depend on the principle that the friction of wood increases temperature, and that if enough friction is produced, combustion will result. The most widely used friction apparatus is the simple hand-drill, a shaft of wood, pointed at one end, which is fitted into a socket cut in a hearth or a second piece of wood. The operation is to spin the shaft rapidly between the palms of the two hands, until a fine powder begins to appear at the point of friction, and this powder glows and smokes. The operator then blows on the powder, which has fallen on some tinder, and the tinder ignites.

There are numerous variants of this basic principle, which have been extensively described elsewhere.[3] What is important here is not to describe them in detail, but to state the fact that anyone who can shape a stick of dry wood into a pointed shaft and another piece into a notched hearth, can make fire; in other words, anyone using the simplest cutting tools can make it.

An alternative technique, on the same level as far as cutting tools are concerned, is the flint and pyrites method. The fire-maker strikes a piece of iron pyrites on a fracture-surface of flint, which will make sparks. If these sparks are caught in dry tinder and carefully blown on, fire is the result. This is an easy and rapid technique, but one which cannot be used everywhere, because iron pyrites do not occur in surface deposits in all parts of the earth. It was used by a few peoples distantly separated from each

[3] Hough, Walter, *Fire as an Agent in Human Culture,* Bull. 139, U. S. Natl. Mus., Washington, 1926.

other, such as the Fuegians, the Greenland Eskimo, and some of the Australian aborigines, all of whom had local supplies of the requisite materials.

Beyond the techniques of the hand-drill and flint and pyrites, there are no methods which have ever been commonly used below the level of flint and steel, which is merely an adaptation of the flint and pyrites method on the level of iron-cutting tools, and that of matches, which have only been made for a little over a hundred years, since they require an advanced knowledge of chemistry.

II. HOUSE BUILDING

Perhaps the most striking use of cutting tools is in the construction of buildings, and in particular of the ordinary dwelling house. By the possession of houses, or other shelters, man is able to take the most dramatic step of all in the modification of his environment; he can maintain a temperature of 70° F. inside his house while it is 30° below zero outside. Furthermore, he can keep dry indoors while it rains or snows without. In other words, he can build a capsule in which he can continue to live in the original, warm environment in which human beings first evolved, and thus he can occupy all environments.

House building may be considered a universal human activity. Although some peoples, like the Central Australians, may sleep out in the open most of the time, they know how to make shelters and do construct them and sleep in them when they camp in one place for any length of time. Other peoples, like the Vedda of Ceylon and the Qara of southern Arabia, live in caves, which, being natural shelters, require no use of tools to construct; but both these peoples leave their caves and live in huts during the dry season of the year.

The types of houses which people build differ widely, being dependent upon two principal factors, the kinds of tools which the people possess and the type of environment in which they live, with its special requirements and materials.

Except in commercial civilizations, where advanced techniques of transport make it possible to move lumber from boreal forests to all other environments, and to carry bricks, steel girders and blocks of stone to distant regions, people are usually dependent upon local materials for house building. For example, almost everywhere in the tropical forests they use wood for building house frames, and palm fronds or other leaves for thatching. Pastoralists, or hunters living on treeless grasslands, make tents of skins or felt, and carry the wooden poles which serve as tent frames about with them. Hunters and reindeer herders in boreal forests make portable or

temporary houses of poles covered with reindeer skin or birch bark. Settled agriculturalists living in arid lands, as in Egypt, Mesopotamia, Mexico, and Peru, make their houses of stone, brick or earth. The *materials* of house-building, therefore, vary from one environment to another.

House-making is almost everywhere purely a hand technique. The simplest subsistence gatherers, particularly those whose search for food makes them nomadic, usually make some form of domed shelter by bending branches of trees or saplings into hoops, and covering the frame so made with skins, mats, or leaves. A camp in Central Australia will consist of a dozen or more low huts made in this way, with leaf coverings. It often happens that one man in the group is more expert at building these huts than his companions, and will build all of the huts in the camp. Since it takes him but a few minutes to make each one, his specialization in house building does not take much of his time, or seriously interfere with his hunting.

Among the Polar Eskimo and other Eskimo who use the igloo-yak, or snow house, each man usually makes his own when they make camp by single families during the winter hunting trips. The house-builder stands inside the circle of snow blocks which he is building up in spiral fashion into the form of a dome, and his sons, wife, or hunting partner hand him the blocks. After he has walled and roofed himself in, he cuts a hole through the bottom and comes out.

Many sedentary agriculturists who build relatively elaborate and permanent houses out of local materials, erect them in a few days by means of work parties. The man who wants to build a house invites many neighbors, kinsmen, and friends to help; all work together, and meanwhile the owner feeds them; when the house has been completed, he gives a feast at which all who have participated eat and make merry. Among Riffians, some of the men will bring stones, others will nick them into shape and set them in the walls, while still others puddle clay for the mortar. When the walls are up, two men, one of whom is usually the owner, climb up and set the ridgepole and rafters in place. Meanwhile other men have been cutting young alders and other small saplings near the stream; they peel these and hand them up in bundles. Most of the men have now climbed to the roof, and they tie these sticks to the rafters to form a foundation for the clay.

Some of the men can obviously perform certain operations better than others; not all are competent masons, nor can all hew the rafters to fit, or adze out the crotch at the top of the central pole which supports the ridgepole in the middle of the house. In the building of this type of house, one

can see very clearly how the technique itself controls the type of interaction of the individuals concerned. There is usually one man who originates action to the rest of the group; he may be the owner of the house himself, or the owner's father, or the village schoolmaster, or some other person who is accustomed to exercise authority in other activities as well.

Among the Galla of Ethiopia, who build circular houses with pole walls and thatched roofs, the procedure is as follows:[4]

There is no house-building during the rainy season or winter, only during the summer. The time is from September through January. The man who is to live in the house gets together twenty to twenty-five men, who are friends or members of his family. Together they can build a house in about ten days. For the first step, the owner sends for a *tumtu* (a member of the blacksmith caste), who has the hereditary privilege of originating action in house-building for pay. The tumtus are supposed to know all about the art, and it would be impossible, from the Galla point of view, to build a house without the aid of one of them.

The tumtu brings a rope and two stakes. He drives one stake into the ground, and ties one end of the rope to it. Then he ties the other end of the rope to the second stake, and with this he describes a circle on the ground, marking it with the point of the stake. This circle is where the wall is to be. All houses are the same size; the radius, that is the length of the rope, is six cubits. (One cubit equals the distance from finger-tip to elbow, usually about 18 inches.) In other words, the radius of the house is roughly nine feet, the diameter eighteen feet. Once the tumtu has marked the circle, then the builders begin to work; they dig a circular trench on the circle, with their hoes; they make it one cubit deep, and one wide; they measure it with a thread to make sure the width is even all around.

Then the workmen set poles upright in the ditch to form a wall, leaving a gap for the doorway. There is no special technique of measuring the width of the doorway. The length of the poles, however, must be measured; a rich man makes them six cubits long (9 feet), and a poor man five cubits (7½ feet). They set the poles so close to each other that they touch. Then they fill the dirt in around the bases of the poles. The poles are always made of one kind of wood, the *badesa*.

Once the poles are in place, the workers take withes which they have cut from the *ebitcha* tree, and tie these around the poles in the form of paired hoops, with one of each pair inside the house, the other outside. They tie these on with strips of *quntche* bark, which they may have taken from the trees themselves, or may have bought at market. The poles and the hoop-withes they cut themselves. They place the hoops one finger span (from thumb-tip to little finger-tip when the hand is spread to the maximum) apart, and each hoop is tied to its mate be-

[4] The following account is taken from unpublished field notes made in Ethiopia by C. S. Coon in 1933.

tween each pair of poles. Once they have tied all of the hoops in place, the men get mud and mix it with teff straw [5] and then plaster this mixture on the walls, inside and out.

At this point the women, that is the wife of the man building the house and her immediate relatives and friends, bring three large stones and place them in the middle of the house to serve as a fireplace. Then the wife makes a bed of wood, about three feet high. Any kind of wood will do. She plants four poles in the ground, and each has a crotch at the top; then she lays four sticks across these crotches to make a frame. After this, she lays a row of sticks of *ebitcha* wood across the long poles to serve as slats, and she ties these sticks to the poles with the same kind of bark which the men use in tying the hoops on the house wall. She builds this bed against the wall immediately opposite the door.

After this, everyone stops working for a while, and the owner of the house kills a goat or a sheep inside it. He kills it in the middle of the house, over the three hearth stones. After he kills it, he collects its blood in a bowl, and throws this through the door, so that it spatters on the top and sides of the doorway. As he kills the goat, or sheep, its head must be turned to the east, and as he cuts its throat he may say: "Let you be good for my house." Some men say this, others do not bother. Then he skins the animal, and cuts the meat into pieces. If his wife is too busy, he will cook the meat, but otherwise she cooks it, and the cooking is done over the new hearth inside the house. When the meat has been cooked, the owner of the house gives pieces of it to all the men who have helped him.

The owner so times the sacrifice that it will take place early in the morning; they eat the meat about nine o'clock. When they have finished eating, the owner and his helpers all go out into the forest and cut poles for the rafters, a piece for the roof-hoop, and six pillars to go in the middle of the house. Then they bring this wood in.

The next procedure is to set up the roof, and for this the owner once more calls in a tumtu. The tumtu measures out a circle with a radius of three cubits from the central stone of the hearth. Once he has laid out that circle, he proceeds to mark the places at which each of the six pillars shall be set. He does this with a stick three cubits long; the same one with which he determined the diameter of the circle. By laying this out six times on the circle, he obtains six arcs of approximately equal length; he equates these roughly by adding a little to each of the first five measured. In marking out the positions of the pillars, he is careful to arrange them so that no pillar will be immediately in front of the door.

Now the owner and his helpers set the pillars in place, and then they make the roof-hoop, which is a single piece of soft, pliable wood bent into a circle, with its ends tied together. In order to make this hoop the right size, they bend a small stick so that it follows the arc of the circle laid out between two pillars by the tumtu; they cut this stick the right length, straighten it, and

[5] Teff is a local Abyssinian cereal.

measure it out six times on the hoop stick; then they bend the hoop stick and tie the two ends at the right place.

The next step is to build the roof-frame. Once they have set the frame on top of the pillars (but not tied it in place), they lay the rafter poles on the house wall and the roof-hoop, so that they converge upward at the center, and their ends overlap like the poles of a tipi. These ends are thin and pliable; a man climbs up and bends them down, tucking them in on the opposite side, so that the top of the roof assumes the form of a dome. Once the rafters are in place, the men tie hoops inside and outside them, in pairs, as they did with the wall poles. Thus the roof-frame becomes a strong unit. They do not place these hoops the same distance apart all the way up; they are much closer together near the top than at the wall level. After this, the next step is to shove shorter sticks in between the rafters near the lower border of the roof, since the rafters are far apart at this level. Thus no large gaps are left in the roof-frame.

After this, they thatch the roof. Not everyone can do this; in fact, none of the men who have worked together in building the house may be thatchers. The owner has to call in two thatchers, who may be Ormoma (upper class) or tumtu; it makes no difference. These thatchers are semi-professionals, and skilled workers. They work up from the bottom of the house to the top, and when they arrive at the top, they thrust a stick in between the frame-poles and tie the straw to this stick to make a point at the peak of the roof. The owner of the house does not pay these thatchers, but he feeds them well and gives them beer, just as he has fed the whole work party.

Now the house is built; only two actions remain before the family can move into it. The first is to build, or obtain, a door; if the father of the owner is dead and no one lives in his house, the owner takes his father's door and hangs it in the doorway of the new house; otherwise he makes a new one. Then he builds a partition six or seven cubits high around the bed which his wife has made, to give them privacy. Beyond this bedchamber he walls off another little room, to store goods in at times, and, when he has them, to house his calves.

Several generalizations can be made which this example of house-building will illustrate. The act of building the house is of interest to the family who are to occupy it, and to the neighbors and kinsmen of the family. The owner of the house originates action in most of the building process, but in building those parts most intimately concerned with family life, the hearth and the bed, his wife takes charge. Although most of the technical activities concerned with house-building are simple enough, so that the average, unspecialized man can take part, there are two processes which require the introduction of specialists, or partial specialists—measuring out the wall and pillar plan, with the use of geometrical techniques, and thatching the roof.

Houses built by these Gallas, and by most peoples in the world who do not employ professional architects, tend to be much alike within given environmental regions occupied by similar people. One can speak of the "Andamanese house type," or the house type of the Kayans of Borneo, or that of the Riffians of such and such a tribe. Among such peoples, the traditional routine of building a house is invariable, down to the actual measurements and sequences of action. This is, of course, true of all kinds of technology, and is by no means limited to house building.

Heating and Lighting. Houses alone are not always adequate to preserve a constant temperature. Many peoples make use, in addition, of fire, to keep their houses dry and warm. In some climates, particularly in tropical forests, where the mean annual temperature varies little, fires are not necessary for this purpose, and all animals except man get along without them. However, all peoples in the world use them to keep their bodies warm and dry; it is a universal practice for people to sit around fires, particularly in the cool of the evening. The camp fire, or hearth, is everywhere the focal point of much interaction, at the time of day when people have come in from hunting, fishing, or work in the fields or factories, and are ready to eat their evening meal and relax in each other's company. At night the area of light which a fire produces forms in itself an enclosure in which people can see each other, and in which their relations to each other, in contrast to the impenetrable blackness outside, become emphasized.

Fires thus serve for heat and illumination. In most environments a simple fire, made of wood, is sufficient, indoors and out. In deserts and treeless grasslands, however, many peoples use the dried dung of ruminant animals as a substitute. In the polar regions, where both wood and suitable dung are unobtainable, the Eskimo, Chukchi, and others burn oil in lamps. This oil is made of sea-mammal fat, shark-oil, or reindeer-marrow. The Eskimo lamp will not give off enough heat to raise a large body of air to a high temperature, but in a small, tightly closed house, with just enough air circulation to prevent suffocation, it makes the occupants comfortable. Therefore, the available method of heating used by these northern peoples, and developed as a substitute for wood, controls the size of their houses.

The direct use of an open fire of wood, dung, or oil is the usual system of house heating. Indirect heating techniques, such as the Chinese kang, the European stove, and the American furnace, are limited to a few of the most advanced civilizations in regions where winter cold is severe. Lighting devices aside from simple hearth fires are also limited; they include oil lamps, fed by olive oil, and widely used in the Mediterranean regions, sliv-

ers of pitch-pine and pine torches, old in Europe and still used in the Balkans, and candles. Gas and electric lights are, of course, the product of the machine age of the last century.

At this point one might also mention the techniques by which people keep their houses cool. This is done in two ways: by the design of the house itself and by the use of fans or other cooling devices. In Polynesia, most of the houses in the hotter islands have no walls, so that the breeze can blow through at all times; in Arabia, the masonry houses are built with lattice windows and small apertures high up in the walls to ensure a constant flow of air. In India, where there is a great division of labor, special servants keep huge fans, called "punkahs," in motion by continually pulling on ropes. By the constant movement of these punkahs, an artificial circulation of air is achieved. Aside from such devices, there are no advanced techniques worthy of mention, short of the electric fan and the air-conditioned room.

III. BODILY COVERING AND RELATED TECHNIQUES

Although the most drastic method of dealing with the climate is to build a house, and thus maintain the air temperature at a constant level within an enclosed area, the needs for acquiring food and the other necessary activities of everyday life force individuals outdoors in all kinds of weather, and in all types of environment. In order to protect their bodies against extremes of heat and cold, against wind and moisture, as well as from such environmental discomforts as thorns and blowing sand, people utilize a wide variety of materials, which they prepare for use by a number of basic techniques. These basic techniques, such as curing skins and weaving, provide them not only with clothing, but also with materials which may be put to many other uses.

As in the case of the techniques of processing metals, there are really two stages involved in making clothing and related materials; the first is the production of *staples,* the second is the conversion of staples into objects intended for specific uses. For example, weaving is a technique which produces a staple, cloth; tailoring is a technique in which the staple cloth is also used. There are two classes of staples used in bodily covering: skins and fibers. In the following pages we shall deal with the techniques of processing each of these, as well as with those employed in making clothing.

A. Techniques of Processing Skins. After an animal has been skinned, the first step in preparing the skin for use is to scrape away the bits of flesh remaining on the inner side, an operation known as *fleshing.* This is done

with a special tool, the flesher, which is a blunt and rather dull scraper made of flint, stone, bone or metal.

If nothing further is done to the skin, it becomes stiff and hard, and shrinks in drying. The resultant product is rawhide, which has limited uses based on these properties. For example, it makes excellent binding for weapon haftings, snowshoe webbing, and shield covers; it is, however, of little or no use as clothing. A number of processes may be employed to make the skin soft; the simplest and commonest is a combination of constant manipulation, beating and wetting alternately. If it is also desired to remove the hair, this may be done by rubbing in wood-ashes and soaking the skin in water. This process is called *currying.*

Skins, which are softened by manipulation and use, suffer from one great disadvantage—after each wetting they become stiff and have to be resoftened by the expenditure of much labor. Curried skins, in particular, need constant attention to keep them in good condition.

Curing skins so that they are relatively impervious to water can be done in a number of ways. One is the application of some such substances as urine, animal fats, brains, and marrow. This technique, based on the use of fats, is not, however, very satisfactory. A somewhat better method is *smoking* the skins over a fire. The only really satisfactory technique, however, is *tanning* the skin with oak bark or with some other vegetable substance which contains tannic acid. Tannic acid is soluble in water, but when placed in contact with gelatinous substances it forms insoluble compounds, and is, furthermore, a powerful astringent. Hence its action on rawhide is to keep the skin from stiffening and from being affected by water. True tanning is limited to the Old World, and even there, it is restricted to the technologically advanced cultures of Europe, Africa, and Asia. Some of the Siberians, however, dye skins with alder bark, which partially tans them.

Tanning can be done by one man alone, but as a rule it involves interaction; the materials, including the skins and the bark or other source of tannic acid, may come from different places, and the tanner himself, who is usually a specialist, is seldom a skinner and bark peeler as well. He usually has apprentices to whom he can delegate the more onerous and malodorous parts of the process: the removal of the hair, with lime and by scraping, and the fleshing. Simple curing, however, as practiced by the American Indians, the Lapps, Bushmen, and others, is usually a family task; the man kills and skins the animal, and his wife cures it. People who practice simple curing do so, as a rule, for immediate use only; the professional tanner, on the other hand, prepares his leather for sale, and it may

be made up into footwear, saddles, straps, and other objects at a later time by persons whom he does not even know.

B. Techniques of Processing Fibers. The techniques by which animal and vegetable fibers are processed may be divided into: (1) Cordage Making, (2) Spinning, (3) Plaiting, (4) Weaving, (5) Fulling, and (6) Felting.

1. Cordage Making. All known peoples make some use of cordage, whether it is for binding haftings on implements, making rabbit nets and string bags, or tying ornaments about their necks. Where skins are much used, as among the Eskimo, this cordage may consist mostly of thongs cut from hides, and animal sinews; people who use few skins and live in forests use vegetable fibers, such as rattan, hibiscus fiber, and spruce roots, which come in such long units that, like thongs and sinews, no secondary treatment is necessary to make them serviceable.

Other fibers, however, are short, and must be twisted together into a continuous cord or thread if they are to be used. Some of the simplest hunters and collectors, like the Australians and the Indians of the Basin states, make a great use of human hair for this purpose; they have no domestic animals to furnish fibers, and the quantity of cordage which they need is not great. Many peoples also use wild vegetable fibers such as apocynum, or milkweed. Flax, sheep's wool, dog's wool, and silk are, of course, obtained by agriculture and animal husbandry and are much more abundant.

Most vegetable fibers have to be decorticated, or removed from the pulp by a rotting process; the usual method is to soak them in water and let the pulp grow loose, then scrape the fibers and hang them up to dry. In the case of cotton, the only preliminary processing needed is the removal of seeds, done by hand everywhere before the invention of the cotton gin. Wool, before it can be used, must be washed to remove the grease.

People who are preparing cordage only, who do not intend to weave, spin fibers together by rolling them with the palm of the hand on the thigh. They often prevent the thread so formed from untwisting by doubling it and letting the two halves grasp each other. Such people usually do not use wool or cotton, but rely almost entirely upon the coarser vegetable fibers and human hair. People who wish to prepare wool and cotton for spinning, first card the fibers, to lay them more or less parallel, then they proceed to draw them out of the mass of fibers and twist them. This technique is known as *spinning.*

2. Spinning. There are four stages of complexity in the technique of spinning. The first is the *hand and thigh* method, as with cordage, and some of the most primitive weavers still employ it. The second is the use of the *spindle and spindle-whorl.* The spinner starts the thread by hand,

and fastens the end of it to a wooden spindle which is set, at the other end, into a circular weight, often made of pottery. The spinner suspends this just off the ground, and twists the thread which she is making by rotating it. After she has spun a length of thread, she winds it around the shaft of the spindle, makes it fast, and repeats.

The spindle and spindle-whorl represent the highest mechanical stage reached anywhere in the technique of spinning before Leonardo da Vinci's addition of the *flyer* to the Indian *spinning wheel,* with which the spinner can not only rotate the spindle to twist the thread, but also wind the thread on it between spinnings. All of the exquisitely fine cloths of Peru and of Ancient Egypt were spun by the spindle and spindle-whorl method. The fourth stage is the power-driven *spinning mule,* one of the most important inventions of the industrial revolution, which permits the mass production of yarns and thread by machinery. Whorl-spinning is still practiced in out-of-the-way parts of the Mediterranean countries by isolated farmers, as in Morocco and Albania; the Peruvian and Mexican Indians also continue to practice it. Wheel-spinning, which is a more rapid process, is also found in regions which are not yet fully commercialized, as in the Kentucky Mountains, the Outer Hebrides, India, and China. The famous Harris tweeds, from the Outer Hebrides, are woven from yarn spun by this technique.

3. Plaiting. Plaiting is a form of weaving in which the operator places the two sets of parallel units over and under each other by hand, without the use of any mechanical device, and specifically without the use of a supporting frame or loom. It is not practical to make cloth by hand plaiting; this technique is really practical only when the elements are stiff enough to stay in place without mechanical assistance.

People use plaiting techniques for two chief purposes: mat making and basket making. Some mats are so fine that they can hardly be distinguished from loom work, but most are considerably coarser. They are usually used for floor coverings, wall coverings, or, as among the Hottentot, as house covers. It requires no tools to make a mat, no force other than the human arm muscles, no interaction between individuals, only simple repetitive operations which, however, require dexterity and skill if they are to be done properly. Mat making, like basket making, is characteristically a household occupation, practiced at all levels of cultural complexity. The reasons for this are that the technique requires no tools other than a simple knife, and no precise timing; and because one person working alone can do it all. As a rule, it is women, working in their spare time in separate households, who practice this technique.

4. Weaving. Weaving, as contrasted to plaiting, is the technique of making cloth out of soft yarn or cordage, with the aid of some kind of frame, as well as, in most cases, of other mechanical devices. Since it is a more difficult technique than plaiting and requires devices which must be made with wood-working or metal-working tools, all but the very simplest types of weaving are limited to people who possess polished stone or metal.

There are two operations involved in weaving: *loom mounting* and *wefting.* Loom mounting is the process of arranging the warp, or longitudinal threads, in a parallel series. Wefting is the process of passing the weft, or transverse thread, in and out between the warp threads, row after row. In the development of the textile industry there is a regular progression in each of these processes from simple to complex. This progression can best be illustrated by a brief, non-technical description of the principal kinds of loom which people living at various stages of mechanical proficiency use.

a. One-Bar Loom. The simplest type of loom is a wooden crossbar suspended between two poles, or a heavy cord stretched tight between them. The warp threads are tied to the bar at the top, and hang down loosely, their parallel alignment being due to gravity. The weaver passes the weft between the warps by hand, thread after thread; at the end of each row he battens the web (pushes the newest weft unit tight against three previously inserted) with his fingers, or with a stick, again thread by thread. With this type of loom, the piece of cloth can be woven no longer than the distance from the crossbar to the ground, which is the distance which the weaver can conveniently reach. It takes a long time to weave a piece of cloth on this kind of loom, and the process is very laborious.

Some peoples, however, have improved the one-bar loom by weighting the ends of the warp threads with stones; this keeps the warp extended and makes it easier for the weaver to pass the weft through, since he can make a shed (i.e., he can raise alternate threads all of the way across the web by turning a flat stick sidewise), and then push the weft through in one operation with a slender rod. When this is done, he can batten the thread by pressing the shed-stick upward, and this, too, is a single operation. The weighted one-bar loom, therefore, is a considerable time-saver when compared to the unweighted device.

b. Two-Bar Loom. The two-bar loom is an even further improvement; in it the warp threads are stretched between two fixed wooden bars, held apart by a frame, or else stretched between a post, or tree, at one end, and the weaver's body at the other. The two-bar loom is usually horizontal, since the warp alignment is not dependent on gravity; hence a longer piece of

cloth can be woven on it than on a vertical one-bar loom. Furthermore, since the warps are held tightly in place, the weaver can use a number of mechanical devices to speed the process of wefting. These include heddles, or rods attached to the alternate warp thread by loops; shuttles, which are boat-shaped capsules containing the weft-thread wound on a bobbin; and reed-battens, or suspended combs with a tooth set between each pair of adjacent warp threads. The weaver who operates a two-bar loom raises and lowers alternate warps by means of the heddles, which he operates by foot treadles. After he has made a shed by one motion of his foot, he throws the bobbin through it from one side of the web to the other, catching it in his other hand. Then he releases the heddle, and swings the reed batten, thus tamping down the weft with a single movement. He thus, in three motions, does the work that would require several hundred motions with an unweighted one-bar loom. He can produce a given piece of cloth in a fraction of the time needed with the simpler device.

c. Two-Beam Loom. The two-beam loom is a machine which differs from the two-bar loom in one fundamental respect: the warp threads are not attached to fixed bars, but to revolving cylinders. As the weaver adds weft after weft to the fabric, he revolves the beam mechanically, so that the cloth is taken up on the near beam and the warps let out from the far one. There are two great advantages to this system: (1) it is possible to weave a bolt of cloth of great length instead of a piece limited to the length of the loom frame; (2) since the warp threads are movable, the wefting is always done at the same place on the loom, and hence the devices used in the three operations of making the shed, passing the shuttle, and battening the web can be attached to stationary pivots. Once this advance has been made, the three motions of shedding, passing the shuttle, and battening, need no longer be done by hand; with this kind of loom it is possible to use water power, steam power, or electric power transmitted through shafts for this purpose. Only after the invention of the two-beam hand-loom, therefore, was the modern textile industry able to develop.

Weaving on a one-bar loom, whether weighted or unweighted, is usually a spare-time occupation, practiced in the home, and usually by women. The cloth so produced is limited in quantity, and, as a rule, made into clothes for members of the immediate family only. Two-bar loom weaving is also usually a non-specialized home industry, but there are regions in which it is performed in factories on a commercial basis, as in early Peru. The two-beam loom, which is a complex and highly efficient machine, is almost always operated by full-time professionals, usually men. In some of the Berber tribes of Morocco, the women weave coarse cloth on one-bar

looms, the men fine textiles on the two-beam machine. The women do their weaving for family use only; the men for sale in public markets. Weaving is for the most part a solitary occupation; the weaver operates his loom alone, and his task keeps his attention so that he cannot do much talking with others while he is at work. Hand-loom weaving, therefore, inhibits interaction, as is the case with many other advanced technical operations. The same is true to a lesser extent with factory weaving in which one operator tends a number of machine looms.

Textiles, as materials for protecting the human body against climatic disturbances, have several advantages over animal skins. It is possible to weave a web of almost any length, and to combine webs by sewing them together so as to produce a sheet of material of any desired size. Skins, however, are limited by the size and shape of the animal, and are not uniform in quality all over their surfaces, as are textiles. Textiles can be made extremely thin or very thick; there is less variation in the weight and thickness of skins. Textiles are made of animal and vegetable fibers which can be produced in great abundance by husbandry; in the case of wool, the animal need not be killed, but may be sheared over and over again, while the use of skins requires the death of the animal concerned. Thus the expense of producing utilizable fibers is low compared to the expense of skins, and textiles are more suited to mass production.

5. *Fulling*. Most cloths woven of vegetable fibers are ready to be used as soon as they have been woven, unless the warps have been stiffened with starch, or some other sizing, to facilitate the insertion of the weft, in which case the cloth must be washed to remove this. Woolen fabrics, however, are often subjected to an additional process, known as fulling. The technique of fulling is to place the cloth in a tub, or other water-tight container, filled with some alkaline solution, such as urine. The fuller then manipulates the cloth with sticks, or beaters, for some time; the cloth usually remains in the liquid for at least three days. During this process the alkali has softened the fibers, which have become felted together through manipulation. Thus the cloth acquires a uniform surface, so that the warp and weft strands are not easily visible, and when the fabric is cut, the threads will not come apart of themselves. Fulling and dyeing are closely related processes, because often the dyestuff is put in with the fulling liquid. When cloth has been fulled, as well as dyed, it must be boiled before rinsing to make the dye fast.

6. *Felting*. Felting is the technique of matting animal fibers, as in fulling, but without the need of weaving as a preliminary step. This may be done by laying carded wool fibers out evenly on a flat surface, wetting them, and manipulating them so as to make them mat together. The non-

commercial technique by which this is done, especially in Central Asia, the home of felting, is to lay the wool out on an old piece of felt, wet it, roll the new layer up in the old, unroll it, and then roll it the other way. This rolling process, with constant wetting, may be followed by dragging the roll along over the ground behind a horse or camel.

Felt has several advantages over cloth. It can be made more quickly, and without machinery or other paraphernalia; it may be made as thick as may be required, and it is hard and impervious to water. On the othe hand, it needs to remain relatively immobile; it cannot stand the constant bending and flexing that cloth receives without breaking or wearing through. Felt is excellent for tent covers, flooring, hats, and boots; it is inferior for most articles of clothing.

7. *Bark-Cloth and Paper Making.* The technique of felting is also applied to vegetable fibers in the manufacture of bark-cloth and paper. Bark-cloth is made in tropical forest regions throughout the world, from the spongy barks of wild and domestic trees, including various species of figs and the paper mulberry. Bark-cloth making is a hand industry, and is seldom done on a commercial basis. It involves three basic operations: (1) stripping the bark off the tree; (2) soaking the bark in water to decorticize the fibers and render them pliable; (3) pounding it on an anvil with a mallet. The pounding process reduces the strip of bark fibers to the desired thinness, and also widens it greatly, while at the same time reducing its length. The bark-cloth maker may join several pieces together by overlapping them and pounding them together, or by gluing them.

The finest bark-cloth is that made from paper mulberry bark; this is cultivated expressly for this purpose in Polynesia and Indonesia. In Polynesia, Africa, and parts of Central and South America, bark-cloth is used by tropical forest people for clothing; it is seldom as soft, as flexible, or as durable as textiles, which, once they have been made available, have a tendency to replace it. In Java, where most clothing is made of textiles, bark-cloth is still used for paper. The papyrus of the Ancient Egyptians, which was made by pounding reeds into flat strips and joining them together, was a material similar to bark-cloth.

Paper differs from bark-cloth and papyrus in that the fibers to be felted are first separated by chemical action. Thus the technique of paper making is a combination of bark-cloth making and true felting techniques. Paper was invented in China, where these two techniques were both practiced. People who do not know how to write have little use for paper; hence paper making is limited to the more complex civilizations, and the per capita consumption of paper, as of metal, rises as the complexity of civiliza-

tion increases. Paper making is always a specialized occupation, whether it be made by hand or in modern paper mills. The mass production of paper has had two important results; it has made it possible for large populations to become literate, and it has provided large markets for the natural resources of the boreal forests in Canada, Finland, and Russia, whence comes most of the world's pulpwood.

8. Animal and Vegetable Plastics. As a further development from the techniques of the textile industry and of paper making, Europeans and Americans have developed, within the present century, techniques of making and using animal and vegetable plastics. These include cellulose filaments, made from woodpulp, such as rayon and nylon, and casein filaments, made from milk proteins. Rayon, nylon, and casein filaments can be made in factories, where most of the machinery is operated automatically, and come out as fine streams of viscous material which hardens in a chemical bath. They can be woven directly without the need of ginning, carding, scouring, or spinning, and thus can be processed more simply and cheaply than short-fibered materials, such as wool, cotton, and silk. Plastics made of woodpulp, soy-beans, etc., can also be cast or pressed into a multitude of forms, and are rapidly taking the place of wood and metal in many manufactured objects.

C. Clothing. Since man is insufficiently equipped with body hair to permit the maintenance of a constant internal temperature in all but tropical climates, he needs some form of clothing if he is to spend any length of time outdoors in environments where the temperature falls, permanently or seasonally, to a level much below 60° Fahrenheit. Furthermore, in tropical climates, clothing is of use in keeping the body dry and free from sunburn, scratches and such discomforts.

The simplest way to protect the body is to cover it with a coating of a mixture of grease and earth, of charcoal, or of clay. Most of the simpler food-gathering peoples of the world do this, no matter what environment they live in, but body paint is particularly important among peoples like the Australians and Bushmen, who live in low latitude deserts and who wear little or no clothing. The commonest substance which people all over the world use for this purpose is red ocher (hematite), a powdered iron ore mixed with grease; this is the red paint which gave the American Indians the erroneous name of "Redskins." It is the one substance which is habitually traded among subsistence hunters and collectors throughout the world. Paint is not as effective as clothing; it must be constantly renewed, and it does not protect the body efficiently. People who use it, however, do not do so wholly for the purpose of protecting their bodies in the direct

sense; they also use it for decoration, and ascribe to it magical protective values.

Nudity. Except for a few strings and ornaments, some peoples go entirely naked. These include many of the more primitive tropical forest dwellers of the Old World, and some of the agricultural tribes of the Amazon-Orinoco rain forest and of Melanesia. In the deserts and grasslands, others may be found; some of the tribes of Nilotic Negroes in the eastern Sudan; most of the Australian aborigines who inhabit the desert areas of north central Australia. It is said that some of the Indians of California and of Texas were also wholly naked at the time of discovery. The only temperate forest people who habitually went naked were the Tasmanians; their country, although cool, seldom experiences freezing weather.

Basic Garments—Breech-Clout and Robe. The basic clothing of the tropical and temperate lands, where any is worn, consists of two main garments, a breech-clout, or apron, usually concealing the genital organs, and a robe, which is an untailored piece of skin, a cape of feathers, or a rectangle of cloth, the smallest of which is usually large enough to cover most of the back, and ordinarily is ample enough to wrap around most of the body. People who wear the breech-clout must frequently "gird their loins" to use the words of the Bible. Those who wear the robe usually discard it when fighting or performing any strenuous physical activity, since it impedes the action of the arms.

The breech-clout and robe form the standard equipment of all the world's most primitive people who wear any clothing at all, from South Africa to Tierra del Fuego. It also forms, or formed, the standard equipment of such technically advanced peoples as the Incas, the Mayans, the Indians of the Northwest Coast of America, and of all the inhabitants of the Mediterranean lands before the introduction of tailored garments—including the classical Greeks, the Hebrews of the Old Testament, and the Romans. The breech-clout and robe are all that is needed in a Mediterranean climate.

Tailored Garments. Life in the boreal forests and the tundra requires something better, something that will keep a person warm and still not hamper his movements. The answer to this is tailored clothing, including shirts or coats, trousers, boots or shoes, and gloves or mittens. The people who are most perfectly adapted to a climate of extreme cold from the standpoint of clothing, are the Eskimo. They are so good at tailoring warm, lightweight outdoor clothing, that Arctic explorers prefer Eskimo costumes to anything that they can bring from home. Throughout the boreal forests

of Europe, Asia, and North America, tailored clothing made of furs and skins are worn by everyone. In the grasslands and temperate forests of the Old World, these garments are also used in modified form. The Chinese costume is tailored, and so is that used by the Central Asiatic nomads, the Mongols and Turks. Trousers are better on horseback than breech-clouts, and the Scythians, notable equestrians of antiquity, probably introduced them to Europe. Our male costume is derived, through medieval prototypes, from this same Asiatic source.

Tailored garments are made to fit the individual; as a rule, they are not transferred. Robes, on the other hand, are strictly impersonal; they may be piled up as a form of transferable wealth, since anyone can use them. Thus on the Northwest Coast, blankets, originally intended for use as robes, became a form of money; in the Fiji Islands the same is true of bark-cloths; and in ancient Greece woven woolen robes served the same purpose. It is only in the machine age of the last century that tailored garments have been mass-produced in standard sizes.

When tailoring is done on a strictly non-commercial basis, it is usually the work of women. Among the Eskimo, Chukchi, Lapps, and other northern peoples, one of the chief duties of a wife is to make clothing for her husband and children. Where, however, specialists in tailoring arise, these are usually men.

Many people still do most of their tailoring by hand, but there is one mechanical device which has spread to most of the world, and is used by almost everyone who does any sewing; that is the sewing machine. The reason why this can be used almost everywhere is that no outside power is needed; it can be operated by hand or by a foot treadle.

Footwear. The human foot is capable of developing calluses which protect it from the discomforts normally encountered in tropical and snowless climates, but the ubiquity of man has made this particular adaptability insufficient. In deserts, men must walk across sands hot enough to blister the hoofs off antelopes, and in the mid-latitude and boreal forests, and in the polar regions snow and ice would totally prevent human travel in winter without artificial foot covering. The ideal desert footgear is the sandal, worn in the Sahara, the Arabian desert, and the deserts of India, as well as in those of the New World. It also penetrated, in antiquity, the Mediterranean area. The northern type of footgear, developed as a part of the tailored clothing complex, is the complete foot covering of leather, which takes the form of the moccasin in North America, and of the boot in Asia. From this Asiatic foot covering come our modern Occidental boot and shoe.

IV. CONTAINERS

Although the possession of cutting tools and some means of bodily protection are the two most basic needs of human beings in their efforts to obtain food and maintain life, a third need, almost equally pressing, is that of adequate containers. Without containers people can transport only such objects as they can grasp in their hands, and they have no place in which to keep their food, water, or tools. Among the lower primates, each individual, once he is weaned, finds his or her own food, and eats it on the spot. Among all groups of human beings, however, there is a division of labor based on age and sex, so that parents bring food to their children, and men usually supply one kind of food, while women supply another. In order for the father of a family to bring home the results of his hunting, and for the mother her roots, berries, or other food, some kind of container is useful, if not necessary.

Containers are particularly necessary to carry water, for unless a person has some hollow vessel in which to put it, he cannot go more than a day's march away from it, and furthermore, under such conditions, every individual would have to leave whatever he was doing to go to a lake or stream every time he became thirsty. In lands where the surface water is frozen in winter, it is absolutely essential for people to have containers in which to melt snow and ice for drinking water.

Materials from Which Containers Are Made. Materials from which people fashion containers may be listed under the following five headings: (1) Natural Containers, which require no processing; (2) Special Containers, which need some processing; (3) Fibers; (4) Hollowed Materials; and (5) Plastics.

1. Natural Containers. There is only one material which is commonly used as a container that requires no shaping or alteration whatever; that is a mollusc shell. Many people use clam shells or oyster shells as drinking cups; in Northern Australia the aborigines carry water in large oyster shells, and boil food in them as well. The natural occurrence of such shells is geographically limited, and there are many parts of the world where they are not available. The majority of the world's inhabitants make all of their containers by some shaping technique, and presumably have done so as long as they have had cutting tools and fire with which to fashion them.

2. Special Containers. There are several different kinds of container which have one thing in common—that they require very little processing to render them efficient. They also have another common feature, that each is practical only in a limited environment where the special materials of

which they are made are available. These types include the ostrich egg-shells which the Bushmen use to hold water; all they have to do is to puncture two holes, blow out the contents and stop one of the holes with gum. Another extremely useful container is the bamboo bucket of South-eastern Asia, Indonesia, and Melanesia; all that is necessary for this is a type of wild bamboo with a broad trunk diameter and long internodal spaces. Anyone wishing a bucket to hold, or even to boil, liquids, need only cut a bamboo stalk below two nodes. He can throw it away, if he wishes, after a single use, because the supply of material is virtually inexhaustible. A third type is the cocoanut shell used throughout Oceania; a fourth is the birch-bark kettle, or bucket, made by all peoples living in boreal forests where an abundant supply of birch is available.

More widely used, since the supply is less dependent on environment, are guts and bladders, for containing oil, and skins for holding water. Water skins are especially useful in deserts, because they hold large quantities and can be transported easily without fear of breakage. Such varied desert-dwelling peoples as the Central Australians and the Arabian Bedouin use skins for this purpose. The Plains Indians of America, who also needed durable containers, made rawhide envelopes, or boxes, called "parfleches," in which they carried their supplies of preserved food on pack horses. Another widely used type is the gourd, which was cultivated in early times in both hemispheres; gourds need little attention to convert them into bowls and jugs; some people, however, shape them by tying bands around them during the growing process.

3. Fiber Containers. Among the most useful and common types of container are those made of cordage and of semi-rigid vegetable fibers. One of the simplest and most widespread of these is the *dilly-bag,* an open-meshed container with a drawstring, useful for carrying vegetables, firewood, and other non-liquid materials. These bags are sometimes made by a knot-netting technique, like fishnets; more commonly, however, they are made of interlocking loops, by a technique related to that of making coiled basketry, and usually called the *coil-without-foundation* process. When this is done with needles, it is knitting. Nearly all of the simple food gatherers of the world, like the Australians, the Bushmen, and the South American Indians from Tierra del Fuego to the Chaco country, use bags of this type; it is standard equipment for women who spend much of their time in the collection of wild vegetable foods.

Basketry proper, which makes use of withes, reeds, etc., and may be rigid or semi-rigid, includes a great variety of techniques, which may be divided into two major classes, *coiling* and *weaving*. It is always handwork,

and requires no implements other than some kind of knife or scraper, and, with some types of coiling, a needle; in some types no implements at all are needed. Materials for basketry-making exist close at hand in almost all environments, and hence women can get the materials within walking distance of their houses or camps, and can make the baskets individually in their spare time, without the need of cooperative effort. These technical factors are no doubt responsible for the universality of basketry.

Among some peoples, the technique of basket making has been developed into a fine art; this is especially the case among the Indians of California. These people made baskets which were notable not only for their esthetic qualities, but also for the tight weaving that made some of them waterproof. They used baskets for many purposes, including boiling foods with hot stones. A common technique to render basketry impervious to water is to coat it with some other substance, such as vegetable gums or clay. The high point of this coating technique is the manufacture of lacquer in Burma and southern China, where the sap of a special tree is painted over basketry, as well as, in some cases, wood or leather.

4. Plastics. By far the most advanced techniques used in the manufacture of containers are those which concern plastics, and, in particular, clay, glass, and metal. By the use of these techniques it is possible to turn out, under modern production systems, great quantities of plates, dishes, bottles, jars, tin cans, pots and pans, and many other kinds of containers. The use of plastics for this purpose, however, had a beginning in simple techniques, some of which are still employed by many of the technologically less advanced peoples.

Clay. The oldest and most widespread technique with which we are concerned is pottery making, the processing of clay. In this technique, several fundamental operations are necessary; these include drying and pulverizing the clay, and freeing it from lumps; sifting it to ensure an even texture; adding some non-fusable material such as ground shell, stone grit, or fine pieces of bark or straw, to serve as tempering; wetting the mixed clay and tempering material; shaping the vessel; decorating it, sun-drying it; and firing it.

Several of these steps require a few further comments. *Tempering* is put in to keep the walls of the vessel from cracking as the clay contracts in drying. *Shaping* is done in a number of ways; the simplest is merely working the clay into shape with the hands; a more satisfactory method is to build up the vessel with separate pieces of clay, and then smooth them together. This may be done by sticking sections together, by superimposing rings of clay, or by coiling. The smoothing is generally done with a stick

or pebble. All of these techniques may be classed as *hand shaping;* all of the pottery of the American Indians and all of that in Negro Africa is made in this way. A mechanical device which makes it possible for the single operator to shape pottery at a much greater rate of speed, and which at the same time enables him to turn out perfectly symmetrical vessels with a minimum of effort, is the *potter's wheel,* a whirling turntable operated by a foot pedal. A further advantage of the potter's wheel, which makes it comparable to the two-beam loom, is that once people have learned to utilize natural sources of power, such as water power, steam, and electricity, they can operate potter's wheels by this means, and begin mass production. Still, however, individual attention of skilled workmen is necessary; a greater advance, from the standpoint of modern industry if not of quality, is the invention of molding machines which can stamp out plates or cups at a much higher rate of speed, as the following advertisement will testify.

> One section of Cambridge (Mass.) long has been noted for its clay deposits. Since 1765, Cambridge clay has been fashioned into Hews flower pots and other earthenware products. . . . The earliest Hews pots were slowly shaped on a potter's wheel. Nearly a century ago the potter's wheel was speeded up (by the application of power) to permit an operator to produce the amazing quantity of 100 pots in an hour. Today each Hews stamping press turns out 1000 per hour.[6]

Fashioning pottery by hand is usually a woman's job, and she makes her pots mostly for use in her own household, although she may sell a few in market. Making it on the potter's wheel, however, is usually a full-time job practiced by male specialists. Men who become potters in countries where the foot-operated wheel is still in use, usually apprentice themselves to masters in the craft, and may specialize as turners, decorators, or kiln-operators. Those who work in modern, power-operated potteries are skilled laborers, who are also specialists within a specialty.

Decorating pottery is done in a number of ways; some, of course, is undecorated. Simple techniques include making impressions on the surface with a scallop shell edge, with a stick, a comb, or by wrapping cordage around it. Painting pottery with colored earths dissolved in water, or mineral ores in solution, is another technique, usually more advanced than that of simple incision.

One of the most important factors in making good potttery is to render the walls impervious to water seepage or evaporation, since fired clay

[6] Pamphlet inserted in bank statement envelopes by the Harvard Trust Company, May 1, 1941.

is porous. The simplest method of doing this is to make a *slip,* a solution of very fine clay and water, and paint this over the surface after the vessel has been dried but not yet fired. This gives the vessel a relatively smooth and impervious surface. A better technique, one which is not known to most pottery makers outside of Europe, China, and the Arab world, is glazing. This is done by dipping or painting the pot with a solution of salt or lead ore or silica, before firing. After firing, this material, which has fused in the process, gives the vessel a glassy surface.

The ultimate in pottery making, from a technical standpoint, is the production of porcelain. This can be made only of kaolin, or pipe clay, which is found in relatively few places. The technique is to shape a thin-walled vessel on a wheel, dry it and cover it with a glaze, and then subject it to a great heat; the temperature will fuse the entire vessel, which will have a glassy ring and be translucent. Porcelain making is a highly specialized, professional activity, limited to China, where it was invented, and to European civilizations.

Glass. Glass, like metal and clay, is a mineral plastic; it is fused silica, which is the substance from which, in the form of flint and obsidian, most chipped cutting tools are made. Glass is ordinarily made by fusing the silica particles in sand. It can be cast in molds, or blown. Although it has been known in the Old World as long as metals, the technical difficulty of handling it, and its great fragility, long limited its use. Glass blowing was a medieval invention which made glass processing much easier, and greatly increased its volume and use. Glass making has always been a purely professional, specialized occupation, like metallurgy.

Modern glass making has returned to the casting and molding stage, which permits mass production on a wide scale. The material of which glass is made is abundant and cheap, the uses for glass almost innumerable. The modern commercial period in our civilization might almost be called a glass age.

Metal. All peoples who process metals make some kind of metal containers. They are superior to clay in that they will not break; to glass, skin, and most other materials in that they will not burn or melt when used for cooking. Among peoples who have little metal, however, and must obtain it by trade, metal containers are a luxury, and most of the metal which they possess takes the form of cutting tools. Pastoralists, who are constantly on the move, find it convenient to use metal cooking vessels instead of pottery. In our modern commercial civilization, metal dishes have replaced pottery as standard cooking equipment, particularly since the mass production of aluminum.

V. TECHNIQUES OF PROCESSING FOOD

As we have seen, no people has ever been found who did not know how to make use of some form of cutting tools. Since man lacks sharp claws, large teeth, and other natural weapons, he must use man-made tools to kill the animals that he intends to eat, as well as to skin them and to cut up their flesh. His primate relatives, being fruit-pickers, grub-eaters, and egg-suckers, have, on the other hand, no need for tools. It was probably the change in manner of living, from the forest trees to the open ground, that forced man first to adopt tools in order to live.

This same change in living habits had a profound effect not only upon the human diet, but also upon the manner of preparing food for consumption. Most monkeys and apes live on such foods as fruits, eggs, honey, grubs, and other insects, and small quantities of the flesh of very small animals and birds; men eat these things too, and also root-vegetables, grains, and the flesh of large mammals.[7] The change of diet which took place in early human times was not one of kind, but of proportions.

Lower primates, which eat all of their foods raw, receive the necessary vitamins; cooking, however, and other food processing techniques such as polishing rice, destroy some of these ingredients. Unless a population consumes a fair proportion of raw foods, it is likely to suffer from dietary deficiencies. In our own civilization we eat raw fruits and salad greens, and an occasional half-dozen oysters; the Japanese and the Polynesians, whose main diet is starch, eat raw fish. The Eskimo, and the pastoralists of East Africa, eat a considerable amount of raw meat. Raw milk, butter, and cheeses are also important from the standpoint of vitamins, to people who practice animal husbandry. One of the ironies of civilization, therefore, is that the development of food-processing techniques, which we are about to discuss, has made many modern civilized men less healthy than their primitive ancestors.

The techniques by which people prepare food for consumption include the use of fire, which all peoples possess, and other processes as well. These techniques vary greatly in ingenuity and complexity. Some of them require elaborate apparatus, others require almost none; some require the interaction of a number of individuals, others can be performed by a single person. The complexity of the techniques of food processing, like that of other techniques, is a measure of the complexity of a civilization.

[7] It is interesting to note that the more specialized primates have developed diets consisting wholly of vegetable materials; the more generalized members of the order, and particularly those which seem to be close to the ancestral line of man, continue to eat a large proportion of animal matter, especially insects.

There are two important and separate aspects to the processing of food: (1) its preparation for immediate use, and (2) the preservation of foodstuffs for future consumption. The techniques of food preparation and food preservation differ in some instances, but are identical in others; it would not serve our purpose to deal with them separately. They can, however, be reduced to two basic categories similar to those which we have found in other technical fields: (A) the Preparation and Preservation of Staples, and (B) Cooking, or the Preparation of Meals.

A. The Preparation and Preservation of Staples

The simplest peoples in the world bother little with the processing of food staples. The Australians, the Bushmen, and the Andamanese, for example, cook their food directly after they have brought it home, and eat it shortly after having cooked it. They are unable to amass large stores of food because they have little daily surplus, and because they have no means of preserving and storing it. Hence they live from day to day, and literally from hand to mouth.

Most peoples, however, above this simplest level do process food staples, and are able to amass some kind of a surplus or store to be drawn on in time of need, and by so doing they can keep the body in a relatively constant state of internal equilibrium, although, as we have seen, even among those who store food, there may be lean seasons when their vitality undergoes a reduction.[8]

The need for preserving and storing foods varies greatly with the environment. In warm climates, where there is little or no seasonal change in the supply of edible plants and animals, there is little incentive to food preservation, either among food gatherers or the farmers whose crops ripen the year round. In higher latitudes, however, where fruits and seeds ripen seasonally and where game migrates in the spring and fall, there are months of plenty and months of potential hunger for those who live by hunting and collecting, and these people must preserve and store food if they are to live. Farmers, too, in these climates are equally affected by the seasonal round; they must lay in stores of grains and roots to last them from one harvest to the next, and to furnish seed for the spring planting. In the case of pastoralists, the tyranny of the seasons is not quite as strong, since they can slaughter their animals at all seasons, but on the other hand, there are times of year when the milk fails, and times when the animals are fat, and other times when they are thin. The Lapps, for example, slaughter their reindeer only in the fall, when they are fat and healthy; if

[8] See Chapter 4, p. 67.

they were forced to kill in the spring, the meat would be maggoty and poor. Only through the knowledge of a food-preserving technique are they able to take this advantage of seasonal variations.

Some peoples obtain enough food by hunting, fishing, gathering, agriculture, and other activities to last them, with careful conservation, throughout the year; others who live in especially favorable environments, or who practice advanced techniques, obtain more food than they need, and this not only gives them added security, but it also frees some individuals completely, so that they need spend no time in the search for food, but can specialize in other pursuits.

As people learn increasingly efficient techniques in other fields, which we have already studied, they also become increasingly efficient in the acquisition of food and in the preparation and preservation of staples, so that within a given area an increasingly large population is able to develop, together with an increasing proportion of specialists and increasing complexity in human relations. Hence it is clear that the extent to which people are able to preserve and store food is a vital factor in their ability to develop complex civilizations.

The techniques of processing food staples may be divided into two main classes: (1) simple processing, in which neither the form of the food nor its biochemical nature is greatly altered; (2) those techniques which involve major alterations, such as pulverization, coagulation, and fermentation.

1. Simple Processing. One of the commonest and most widespread techniques of processing food staples is *drying*. In hot, dry climates this is especially prevalent, and the heat of the sun is usually sufficient. For example, in the Mediterranean region, it has long been a practice for farmers to preserve their surplus crops of figs, grapes, apricots, and other fruits simply by drying them on the roofs of their houses in the hot, clear days at the end of the harvest, so that they will last through the rainy season. Meat, as well as fruit, can be sun-dried, if it is cut into thin strips and hung on racks; the Plains Indians preserved their seasonal surpluses of buffalo meat in this way. Even more important is the preservation of fish by this method; dried fish is a staple food in some of the world's most densely populated regions, such as China, India, and Europe.

Smoking food is an extension of fire-drying, which is practiced in environments where sun-drying is insufficient. Foods that are hung over the fire, or in the rafters of chimneyless houses, become saturated with creosote, which not only gives the food the familiar taste of ham, bacon, and finnan-haddie, but also preserves some of the juices, so that complete

dehydration is unnecessary. A third technique which also permits the retention of some of the juices is *salting,* a fourth is wet-salting, or *pickling* in brine. Smoking, salting, and pickling are advanced techniques which are largely confined to the more elaborate civilizations of the Old World, and were much commoner in our own country a generation ago, before the development of refrigeration, than they are today.

A variant technique of simple food preservation is to seal perishable materials in fat, which is relatively impervious to bacterial action. The Plains Indians preserved their pemmican, or powdered buffalo meat, in rawhide parfleches by saturating it with melted fat; the Maori of New Zealand used to put down plump birds in boxes by covering them with their own grease. A variant of this technique is sausage-making—preserving chunks of meat with fat in a section of intestine, stomach, or bladder. Sausage-making is especially developed in the boreal forest regions of both the Old World and of North America, where meat is the principal diet, and where the supply of food is seasonal.

Another technique, freezing, is almost completely dependent upon environment. The Lapps, as we have seen, kill their reindeer in the fall, when the meat is prime, and keep it frozen until just before the spring thaw, when they smoke it so that it will last through the summer. The Eskimo can keep meat ten months of the year without any effort. This ability to freeze meat is one of the few advantages which a boreal or polar climate offers.

With the advance of modern mechanical and chemical knowledge, people in this country invented, within the last half century, means of freezing food in all climates, and of carrying it long distances in refrigerator ships and refrigerator trains. This invention has had far-reaching consequences—it has enabled people in favorable regions to specialize in certain types of food production, with the assurance that their products will be marketed; for example, it has permitted the shipment of Argentine beef to England and of western meats slaughtered in Chicago to all parts of the United States. With the invention by Clarence Birdseye of his quick-freezing process, vegetable foods, as well as meats, can be frozen effectively, and therefore great advances in specialization and distribution are possible.

A second modern invention of equally sweeping implications is that of *canning,* or preserving bacterially sterile foods in air-tight containers; refrigeration and canning together have greatly altered the economics of food production and food distribution throughout much of the world, with profound effects in the fields of social complexity as well as of nutrition.

2. Pulverization. Foodstuffs rarely come in size units which form convenient mouthfuls; most meats and vegetables need to be cut up before they are eaten. The ultimate in size reduction is pulverization, or the reduction of foodstuffs to flours. Flours, whether made of grain, meat, or fish, are easily packaged, easily stored, easily transported, and easily cooked in convenient units of size and shape. Flour makers, as a rule, are people who know how to preserve food for future use. A convenient way of storing flour as well as preparing it for future cooking is to wet it and then mold it into some special form—flours so processed are called *pastes*. The best known paste is macaroni, long used by the Chinese, and said to have been introduced into Italy by Marco Polo.

There are two principal techniques of pulverizing foodstuffs: by pounding with a mortar and pestle, and by milling or grinding. Both of these techniques are widespread and are often used by the same people. Of the two, however, milling is the more variable and is the only one which has become a major industry. In its influence on the rise of modern civilization it is comparable to the techniques of metallurgy, weaving, and pottery-making.

Milling is an operation in which grain is ground between two stones, a lower, or nether, stone, which is stationary, and an upper stone, which is movable. The simplest milling device is the *simple metate,* a semi-porous, or granular, stone, on which people grind up seeds and grains by rubbing on top of it a smaller stone, or *mano,* held in the hand. A more efficient device, in the mechanical sense, is the *cylindro-concave metate,* which is a rectangular block of stone which resembles a section cut out of a large trough. The mano used with this type of metate is a heavy stone cylinder, shaped like a rolling pin; the operator rolls this back and forth at right angles to the axis of the trough, and the weight of the mano, rather than the force of the operator's arm, does the crushing. A still greater improvement is the use of the *rotary quern,* the common European hand mill, which consists of a circular nether stone with a pivot in the center, and a disc-like upper stone, which rotates on the pivot and is turned by a handle.

The simple metate, which is the most laborious of these three devices to operate, can be made by anyone who is willing to look for flat stones, and hence it is in use among the simplest food gatherers, such as the Australians and the Californians, who consume wild seeds and grains. The cylindro-convex metate, on the other hand, requires expert stone cutting, and is limited to advanced agricultural populations, such as those of the Indians of Mexico and of the Peruvian highlands, and of the Ethiopians. The rotary quern, however, requires not only expert stone cutting, but

also a knowledge of the principle of the wheel, and hence is further limited to the advanced civilizations, ancient and modern, of Asia, Europe, and North Africa. It has been of particular importance in the development of our modern industrial civilization for one reason: *it was the first kind of machinery to which people applied natural power,* instead of the muscular power of men and animals, and this required the use of shafts and wheels. The Romans invented the undershot mill-wheel, driven by the waters of the Tiber, in order to supply the city's demand for flour. From this first application of the principle of using natural sources of power through the wheel, developed in turn the overshot wheel and the windmill—and all the other applications of this principle upon which our modern civilization depends.

3. The Removal of Inedible Substances. Some foodstuffs cannot be eaten, or conveniently stored, until inedible substances such as hulls, husks, pulps, stones, or disagreeable or poisonous juices have been removed. For example, acorns and horse-chestnuts contain tannic acid, which renders them disagreeable; hence the Indians of California pound the meats of these seeds to a pulp in mortars and then spread this out on mats on the bank of a stream. They soak the pulp thoroughly with water, and dry it ten times in succession, after which it becomes nearly tasteless and can be cooked into a porridge. Thus the Californians were able to utilize an abundant source of food, which would otherwise be inedible; and the area was able to support a larger population.

Similarly, South and Central American Indians grow two varieties of manioc, a sweet but poisonous plant. In order to make it harmless, the Indian housewife grates the roots on a slab of wood in which stone flakes or palm leaf spines have been set as teeth; she then puts the pulp in a diagonally woven, basketry tube. This tube is attached to a stationary bar overhead, and a log is fastened to it at the bottom as a weight. When the log is allowed to pull on the tube, it contracts, squeezing out the juice. Often the operator adds his or her weight to that of the log.

4. Techniques of Processing Milk. Many peoples in the world do not use milk as a food, except in infancy. In pre-Columbian times it was unknown in the New World, and in the Old World limited to the pastoral and mixed-husbandry regions of Central Asia, Europe, and Africa. However, unless the people who rely on milk as a food had some way of processing it for storage and transportation, it would turn sour soon after milking, and be wasted. The techniques which different people employ in processing milk depend to a large extent upon the kind of milk in question. For example, only cow and buffalo milk are good for butter making, since they

are the only kinds that will separate naturally while still sweet into cream and buttermilk. Mare's milk is the only kind that can be fermented, as it is the only one with a high enough sugar content.

Butter-making consists of two operations: skimming the cream and churning it. In Central Asia, the usual churn is a skin hung from a tripod or tree, which the butter-maker swings back and forth. In Africa, it is often a gourd. The European method is to move a plunger rapidly up and down in a tub full of cream. The churning process ruptures the oil sacs in which the butter fat is contained, and liberates it so that it may coalesce into a vitreous solid.

The butter itself, however, is subject to the action of lactic acid bacilli, and will turn rancid if nothing further is done with it. One way to prevent this is to salt it and keep it cool; this is the European and modern American system; in India, East Africa, and Central Asia it is boiled. Boiled butter, which is called *ghi,* will remain solid at high temperatures and will keep for long periods.

As we have pointed out, butter consists largely of the fats contained in milk. Besides these fats, milk also contains relatively large quantities of protein, which may be isolated by the process of curdling. There are several ways of curdling milk; the simplest is merely to let the milk stand until it has begun to sour; the action of the lactic acid bacilli separates the curds, a relatively solid mass of a jellylike consistency, from the whey, the watery residue. It is a common practice of Central Asiatic nomads to allow the milk to sour enough for the curds to separate, and then to boil the curds to stop the action of the bacilli. This boiling process also hardens the curds, and when they are subsequently sun-dried, they become as hard as leather and may be kept indefinitely and easily transported. In this form, preserved curds form an important food for these nomadic people.

A third technique of processing milk is cheese-making, which consists of forming a sweet curd by the use of rennet,[9] and pressing this in a mold. Most cheese is not ready for consumption until it has been ripened, that is, until it has been left in a chamber at an even temperature for a period varying from two weeks to two years. During the ripening process, the enzymes in the milk itself, the pepsin in the rennet, and the bacteria convert the insoluble curd into a more easily assimilated substance. Cheese-making, which is one of the finer arts in food processing, is an extremely elaborate process, of which only the essentials have been mentioned here; it is an art almost entirely limited to Europe and modern America.

[9] The stomach lining of a suckling animal, which contains an enzyme which curdles the milk without souring it.

5. Fermentation and Distillation. Fermentation is the technique of converting the sugars in certain foodstuffs into alcohol by bacterial action. Since alcohol is a preservative, one of the important features of this process is that it permits the preservation of great quantities of perishable food, as in the case of wine-making. Also, since alcohol has the well-known effect of inhibiting the action of the cortex, many peoples use drinks processed by fermentation as valuable and habitual aids in stimulating interaction. The use of this technique, however, is rather limited, since it requires a surplus of foods which can be fermented satisfactorily. In the New World, the Indians of tropical Central and South America fermented maize, manioc pulp, the sap of the century plant, and the juices of a number of fruits; in Indonesia and Southeast Asia, cocoanut sap is the usual material; in Negro Africa, China, Japan, and most of Europe, it is grain; in the Mediterranean region of Europe and the Near East, it is grapes; while in Central Asia nomadic peoples ferment mare's milk.

Wine-making, the traditional technique of the Mediterranean region, is a relatively simple process. The pickers dump the grapes into huge vats, and then jump in and trample them with their bare feet. When the wine has completely fermented, the pulp and seeds will have settled to the bottom, and all that remains to be done is to siphon off the wine into air-tight containers to prevent its turning to vinegar. Since wine-making is a seasonal activity which requires quick work on the part of a large number of people, and since the wine itself is a medium of merriment, the wine season is traditionally a high spot on the calendar of annual activities in the countries where this technique is practiced.

Beer-making, which is much more widespread, differs from wine-making in one essential; in the case of wine, the yeasts on the skins of the grapes convert the fruit sugars directly to alcohol, while in the case of beer, it is first necessary to convert the starch of the cereal used into sugar before the fermentation can take place. There is one principal means of doing this—by the process known as malting. This consists of letting the grain sprout, drying the sprouted grain, grinding it into a grist, and dissolving the grist in water. The sprouting process produces in the grain an enzyme known as diastase, which converts the otherwise insoluble starches into crystalline sugar and maltose.

Primitive brewers, as in Africa, do not boil the grist, and hence do not kill the natural yeasts which occur on the grain, and which live on the fermenting bowls from one brewing to another. The beer which they make is consequently cloudy and weak. Advanced professional brewers, as in Europe and Japan, boil the grist, and hence allow the water to absorb

a large proportion of the converted sugars, since the process of conversion is speeded by the rise in temperature. This boiling kills the natural yeasts, and in its place a special yeast culture, the brewers' yeast, must be added. This yeast is the pressed foam from former brewings. European brewers' yeasts have been selected so long that the species now in use cannot be found in the wild form; they are, in effect, domesticated plants.

A modern brewery is a specialized industrial plant with much complicated machinery and a staff of trained workmen under the direction of a brewmaster. The beer and ale which they produce bears little resemblance to the cloudy product of the primitive brewers of such regions as East Africa.

Aside from the wine-making technique, in which the fruit is pressed and the natural yeasts do the rest, and the beer-making technique, in which the grain must be malted to convert the starches into sugars, there is a third source of fermentation—namely, chewing. In South America, many tribes of Indians make *chicha,* or maize beer, by chewing the maize into a pulp and then removing it from the mouth and placing it in a bowl with water. The saliva contains, as well as bacteria, an enzyme which converts some of the starch into sugar. The beer so produced is of the thickness of thin breakfast cereal or gruel; it is halfway between a food and a drink. This fermentation-by-chewing process is also applied to fruits as well. In Polynesia and Melanesia, it is also used in producing *kava,* a drink made from the root of a domestic pepper plant.

The fermentation process is used in making a number of foods, aside from beverages. The most familiar of these is raised bread, in which the yeast is used to produce gases which make the dough light and porous. Another is to ferment fish into a paste, as practiced by the Northwest Coast Indians, Polynesians, and Indonesians. The Polynesians also ferment breadfruit paste into a delicacy known as *poi.* In Europe and America, soft cheeses are produced by bacterial action. In all these cases, the technique consists of leaving the food in a damp place for some time; the result of the fermentation is not to produce alcohol, but a partial decomposition.

Distillation. From Alexandrian times onward, peoples in the Mediterranean basin have produced turpentine from pine-pitch by the process of distillation, which need not be described here. The Arabs, during the Dark Ages, applied this turpentine-making technique to wine, and made the first brandy. Since then the production of distilled alcoholic beverages has been a major industry in many of the more advanced nations of the Old World, from Scotland to China.

them at one time. In Polynesia and Melanesia, people preparing for feasts will cook a dozen pigs and a ton of taro in one oven.

Aside from the use of ovens, the most important technique of cooking by indirect heat is *boiling*. This ordinarily requires containers which are both water-tight and fire-proof, and the only materials which normally meet these specifications are pottery, stone, and metal. There are, however, ways of evading these requirements; for example, the Indians of Canada and Alaska boil in birch-bark kettles held over coals but out of reach of the flames; the Indonesians and peoples living in Southeastern Asia boil food in green bamboo sections—they let the bamboo char, and when they have once used it, throw it away. Another ingenious method of boiling without fireproof containers is *stone boiling:* dropping hot stones in the vessel. In the grasslands of Central Asia, and on the North American plains, nomadic peoples have long cooked meat in this way by digging a hole in the ground, lining it with a freshly flayed skin, putting in meat and water, and dropping in the pot-stones. This technique is usually practiced by men when they are traveling light on hunting or war expeditions; it is an emergency technique. However, some peoples who lack pottery regularly boil their food in this way; the Northwest Coast Indians use wooden boxes, the Solomon Islanders wooden bowls, and the California Indians water-tight baskets.

Deep-fat frying, steaming, and *stewing* are variants of boiling; the first is actually boiling in oil; the second boiling through steam, with the food kept apart from the water; the third, boiling food in its own juices in a thick-walled vessel. All three of these are advanced techniques which are limited, as a rule, to advanced civilizations.

Cooking and Civilization

In general, the amount of alteration which people make in foodstuffs when preparing them for consumption is an index of the complexity of their total adjustment to their environment, and of their degree of specialization and of trade. For example, the Australian aborigine has no composite dishes; he cooks his meat and wild yams by simple roasting, and washes them down with water only. He has no seasoning, sauce, or alcoholic beverage. The Greeks of the age depicted by Homer, when feasting in a kingly hall, would have a spitful of roasted meat cubes brought and deposited on a small table by the side of each guest, beside his basket of unleavened bread and his cup of wine. The American Indian of the eastern United States, in some respects, fared better; he ate many composite dishes consisting of maize, beans, and fish or meat; among these was succotash, a

mixture of maize kernels and beans. The Caribs and Arawaks of the West Indies and Guianas kept a pot constantly on the fire, filled with boiling fish, vegetables, and peppers. The Melanesians and Polynesians occasionally ate baked puddings made of vegetable pastes combined with fruits and seasoning.

As a rule, the *haute cuisine* is a product of elaborate commercial civilizations. The Egyptians set a sumptuous table, and so, in later times, did the Byzantines. The Byzantine cooking has come down to us in the Turkish, Armenian, Greek and Arab cuisines; nothing could be much more elaborate than Near Eastern meals of stuffed, pickled grape leaves, chickens stuffed with raisins and almonds, stuffed squash, pilaffs, borghuls, and such sweetmeats as kadaif and baklavas. Our own *haute cuisine,* as exemplified by French gastronomy, also reaches a high level of complexity, as does that of the Chinese, who have developed the technique of cutting all materials into small and easily handled units. The Chinese obtain their foodstuffs from far afield; for example, they eat sharks' fins brought from the Red Sea, and birds' nests from the interior of Borneo.

Haute cuisine is not the practice of the simple housewife who has other family duties to perform besides cooking. It requires the full-time work of special chefs, trained through a lengthy apprenticeship. Family cooking is almost always the work of women. Usually each wife prepares her husband's and children's meals. In some places where people live in large extended family groups, as among the Bemba of East Africa, the women form cooking teams, under the guidance of an old grandmother, who is usually the most expert and teaches the younger women. In other regions the whole family may participate in the preparation of a meal, provided that the men have no other work to do; Firth gives an excellent account of such a sequence of events in Tikopia, which illustrates how the preparation of food controls the interaction of the family members.[10]

A considerable amount of cooperation takes place among the members of a household at such [a] time, and each plays a part in the division of labour. . . . [For example], breadfruit pudding is being prepared in Nukutaukara, the house of Pa Maniva. . . . The breadfruit are roasted on the oven-stones by two women, his married daughters (his wife being dead), while in the dwelling house a son, Rakeimuna, grates cocoanut and proceeds to express the cream. The breadfruit when cooked are peeled by the women in the oven-house and brought in steaming hot, wrappd in *pilaka* leaf. The father cuts them up and puts them in a wooden bowl, assisted by one of his daughters, while Mairuja, another son, cuts a pestle and begins to pound the food. After some minutes the father takes

[10] Firth, R., *We, the Tikopia,* London, 1936, George Allen and Unwin, pp. 100-101

a spell at this work, and later the son takes the pestle back, the mashing of the fruit demanding considerable energy. Mairuja calls after a time, "Are the breadfruit ended?" His sister in charge of them answers, "Yes." Then turning to the cream producer, he asks, "Finished or not?" "Wait a while," his brother replies. Soon both jobs are ended, and the two men combine, the one squeezing his cream over the pudding while the other continues his pounding. The father meanwhile is tearing up *pilaka* leaf to hold the portions. A younger son, who has taken no part in the more energetic operations, passes him half a cocoanut shell, which he covers with banana leaf and then uses as a spoon to scoop out the food. Mairuja, his pounding over, now licks the pestle clean, while the other members of the family hand round portions on their leaf platters. The meal is then begun.

Truly specialized cooking, the *haute cuisine* of Europe, the Near East, and China, is not performed by women or by groups of women occasionally assisted by men; it is a full time masculine profession, and *chefs de cuisine* are highly honored in civilized societies. In this respect cooking resembles other professional techniques.

The best cooking is always done with the use of fire and of hand labor. No device has yet been found, depending on machine power, which can rival hand cooking, although machines for preliminary processing, such as those for slicing, grinding, peeling and the like, have rendered the more laborious actions of the culinary technique easier.

Eating food together is an essential part of the activity of the family in all human adjustments. It is a daily action, recurring with a definite rhythm, which helps restore the bodily equilibrium of each individual, and hence is a "pleasant" operation. It has a highly symbolic content, and is one of the basic activities in which the members of a family interact with each other. For this reason, cooking has not, in any type of adjustment, no matter how complex, taken on the full status of a commercial activity comparable, for example, to smelting or to the manufacture of textiles.

CONCLUSION: THE ANALYSIS OF TECHNIQUES

In studying the various techniques covered in this chapter, we have seen the emergence of several principles, which together govern the relations of man to his environment. One of these principles is that the nature of each technique depends to a large measure upon the implements, or machinery, used in its completion. For example, it is impossible to weave without a loom, or to grind grain without some kind of a mill. Each of these techniques varies in terms of the *type* of machine; there is a definite progression in the case of weaving depending on whether a one-bar, two-bar, or two-beam loom is used. In the same way, the whole adjustment of

people to their environment in terms of milling depends on whether they use a simple hand mill or a more efficient rotary device. In the case of pottery-making, to cite a further example, the relationship of this technique to human institutions depends on whether the potter works by hand, with a foot-treadle wheel, with a powered wheel, or a press. Thus one basic factor in each technique is the *implement,* or machine, employed, which, as we have previously seen, depends ultimately upon the type of cutting tool that fashions the implement concerned.

A second factor is the action, or sequence of actions, performed. The weaver performs a sequence of three actions—shedding, wefting, and battening; the potter goes through a larger number—grinding and sifting the clay, adding tempering matter, wetting the tempered clay to a desired consistency, shaping the vessel, and firing it. In many cases, different men perform these techniques separately. The technical actions which workmen perform vary greatly in the amount of training and skill needed. There is, for example, a great difference between the skill involved in making a wooden spear and that needed by a maker of violins. In the case of the simpler techniques, one man usually knows several; with the more difficult ones, specialists are needed. Yet even in the case of specialists, there is a definite limit to the amount of manual skill which the average human being can acquire; the California Indian woman who makes a feathered basket may be just as skillful as the machinist in the Ford plant who grinds valve-seats in new motors. The whole point about machinery is that you put the skill of the gifted worker into the designing of the machine, and the ordinary worker who operates the machine need not be highly trained. Thus mass production requires less training than hand work; employees in a shoe-factory are not as skilled as hand shoemakers, yet they produce many more shoes per capita, by means of simpler sequences of action.

A third factor, as we have seen, is the *source of power* employed in the performance of the technique. Most techniques, particularly in the simpler groups, are performed by hand; the force employed is that of the technician's own muscles. Thus the hand-loom weaver and the potter, with or without his wheel, are hand-power operators. In some societies, however, people have devised means of using the power of animals instead. This is an advance in that it frees the operator from the machine, in that most animals are stronger than men, and in that the man so freed can tend many machines at once, or leave the animal working while he does something else. A far greater advance is the use of natural forces through machines, as in the case of windpower, waterpower, steam, and electricity. An example of a progression through these stages is that of milling machinery,

from the metate and hand-rotated quern, to the animal-operated mill of the Romans, to the waterpower mill and windmill, and finally, the huge modern grain mills operated by electricity derived from water power. In milling as in other techniques, these three steps in the utilization of power make it possible for a single individual to produce increasingly large quantities of processed materials or objects per working hour.

The fourth factor is the *interaction* involved in the technique; some techniques, like weaving, are solitary tasks and in their simpler forms inhibit interaction; others, like house-building among the Gallas, can be done by large work gangs of men, and offer an opportunity for much interaction; still others, like the construction of a modern office building in an American city, not only permit interaction, but make it necessary, since a large number of men performing different skilled tasks must work together if the job is to be done.

Thus the nature of the technique itself dictates the amount and complexity of the interaction which is needed if the task is to be completed. For example, the Northwest Coast Indians have good timber and good cutting tools, and need warm and water-tight houses in their particular environment. They build these houses from the materials available, and their technique, therefore, includes hauling heavy posts and beams to the site, setting up the posts, and hoisting the beams into place. These are operations which one man could not perform without great difficulty, if at all. Therefore the technique of house-building itself creates a special relationship between a number of men. This is true of all techniques; the building of a new factory in a town creates new forms of interaction between the people who live there. The techniques which people practice, therefore, have much to do with the determination of the complexity and character of their institutions.

Having isolated and defined these four component factors which together make up every technique, we shall, in the next three chapters, use them as criteria for the description of the techniques with which we shall be concerned. By this means, the relations between techniques and the relations between individual techniques and total adjustments to the environment will be made comparatively clear.

SUMMARY

We now consider how the technical processes which people have devised enable them to develop their various types of adjustment to the landscape. The basic factor on which all other techniques depend is the invention of cutting tools. The simplest of these are chipped flint, mollusc shells, fish-teeth, and bamboo slivers. People who have no other equipment can make

these tools, and with them they can skin animals, cut meat, do the simpler forms of woodwork, and shape such other materials as bone and ivory. Polished stone tools, which require more effort to make, permit people to fell trees, and thus do more elaborate woodwork and also prepare the ground in forested regions for agriculture. Metal tools are the most effective of all because they will keep a sharp edge, are less fragile than the others, and can be made into a great variety of shapes, since metal is a plastic.

Other techniques which we consider in this chapter are: fire making; house-building; the preparation of skins; the manufacture of cordage and textiles, felt, bark-cloth, and clothing; the manufacture of containers from various substances, including fibers, clay, glass, and metal; and the techniques of processing food both for storage and consumption. Several techniques, such as metal-working, textiles, pottery making, and milling, receive especial attention because these are key techniques from which the adjustments of complex civilizations have developed.

Each technique should be considered from several standpoints which will have a bearing on our later study of human relations; for example, how the technique is adapted to the landscapes in which it is used, and whether the technique is designed to produce staples, such as flour, lengths of cloth, ingots of metal, etc., which can be stored for future use, or objects ready for immediate use, such as loaves of bread or houses. It is evident that the amount of time spent on the preparation of staples designed for storage, and particularly their ability to preserve food against seasonal variations in abundance, is a function of the relative complexity of a people's adjustment to their landscape.

Each technique can be divided into four component elements: (1) the implements used, (2) the forces employed, (3) the actions involved, and (4) the amount and variety of interaction needed for its completion. This division will serve as a convenient means of measuring the relative complexity of techniques, and will also furnish a background for the study of the development of institutions.

CHAPTER 7

Gathering—The Acquisition of Natural Materials

INTRODUCTION

In the last chapter we saw some of the principal techniques by which human beings adjust themselves to their environments, by making tools, providing shelter, and processing food for consumption. In order to obtain the materials which they eat and from which they make tools, houses, clothing, containers, and the like, people have to practice other techniques as well. It is these techniques of *obtaining materials* which form the subject-matter of this and the following chapter. In the present chapter, we shall concern ourselves only with the techniques of obtaining *natural* foodstuffs and other materials from the landscape, i.e., the techniques which are included under (1) collecting, (2) hunting, (3) fishing, and (4) mineral extraction.

Unlike the techniques of agriculture and animal husbandry which will be described in the next chapter, these gathering techniques are universal; all peoples practice some of them. Furthermore, within these techniques is found the entire range of complexity in human activities. There is nothing simpler, for example, than an Australian woman digging a wild yam out of the ground with a pointed stick, or a New Englander, Indian or white, picking blueberries into a birch-bark basket or tin pail. In either case, yam-digging or blueberrying, the implements used are simple, the actions equally so; the force used is the human arm, and one pair of arms can work alone. At the other end of the scale one finds such complex techniques as lumbering in Canadian forests, coal mining in Pennsylvania, whaling on a modern factory-ship, and the operation of a modern Japanese floating salmon cannery.

It is our purpose in this chapter to study these techniques, and others which are intermediate in complexity, in a manner which will have bearing on the total question of the development of human institutions. In order to fulfill this purpose, we shall therefore follow the system outlined at the end of the last chapter, and describe each technique in terms of the four component factors listed there: (1) the *implements* used; (2) the *actions* per-

formed; (3) the source of power, or *force* employed; and (4) the ***interaction*** needed for the completion of the technique.

I. COLLECTING

The acquisition of animal and vegetable foodstuffs by the techniques of picking them up off the ground, uprooting them, plucking them from stalks and branches, and picking them out of nests, is the simplest type of food-getting activity practiced by human beings, and the only one which is also practiced by the other primates; it is the only way that the latter can gather food without weapons or tools.

Among many subsistence gatherers, collecting forms the principal means of obtaining food. Some of the Indians of California, Nevada, and Utah lived largely on the acorns, grass seeds, and pine nuts which they collected; in years when locusts swarmed over the countryside, they gathered these insects by the basketful and subsisted on them as well. In other regions where the balance between available wild vegetable and animal foods is more nearly equal, as, for example, in Australia, the women go out daily to dig wild roots to supplement the meat killed by their husbands.

The products which people collect include not only wild seeds, nuts, roots, and other vegetable products, but also insects, molluscs, crayfish, lizards, snakes, and land tortoises—in other words, those small animals, whether vertebrate or invertebrate, which are immobile or slow moving, or which can be dug out of their holes without difficulty, or pried off the rocks to which they are attached.

The implements with which people do their collecting are usually simple. They consist, as a rule, of nothing more than a sharpened stick of hardwood, known as a digging-stick, and a bag of fiber netting, a basket, a birch-bark bucket, or some other simple container. With the former, they are able to unearth roots and small burrowing animals, and to pry shellfish from their rocks; with the latter, they can carry home the results of the day's gathering. The *force* utilized is seldom more than that of the human arm. The ***actions*** involved in collecting are as simple as the instruments; all that the collector ordinarily needs to do is to find the objects, pick, pry, or dig them up, and take them away. It is not even necessary, in the case of many of the animals so secured, to kill them.

Except in commercial enterprises such as oystering and lumbering, no elaborate techniques have been developed for collecting, and the ***human relations*** between individuals who do the collecting have remained on the simplest possible level. Most collecting techniques, particularly those of food-collecting, with which we are principally concerned, do not require inter-

action for their completion; each person, like each gorilla or other lower primate, can secure the berries, pine nuts, etc., that he is collecting by solitary action. However, there is, as a rule, nothing to prevent people from collecting in groups if they wish to be together for any other reason. When abundant seasonal crops such as berries, pine nuts, and some fruits ripen all at once in great profusion, it is a common practice for simple collectors to work in groups in which many individuals all perform similar but independent actions, simply for the purpose of interacting with each other, i.e., for companionship.

Anyone who can walk and use his fingers can collect food, if there is any to be collected. Hence in regions where other techniques such as hunting are also possible, food-collecting is left to the women and children, while the grown men pursue techniques which take them away from camp or home for longer periods of time. The reason for this division of labor is not so much because women are less agile or weaker than men, as that women, since they bear children and suckle them, must spend much of their adult lives looking after their babies and young children. They can take their children with them on gathering expeditions, but the children would certainly interfere with the hunting. In some types of hunting, however, such as the surround, which we shall presently describe, speed, dexterity, and silence are not at a premium, and as many people as possible are needed; and in these types, women and children often join with the men. Furthermore, women often set traps and collect the animals caught in them, when the traps can be set near enough to the camp or house; this is the case among the Polar Eskimo, whose women trap foxes in deadfalls and catch hares in nooses, while the men do the hunting that takes them far from home. In some environments, however, hunting is relatively poor, and collecting more profitable; hence the men may spend part of their time gathering nuts, roots, and berries with the women. This is the case among the Kalahari Bushmen, for example, and among the Indians of California, Nevada, and Utah.[1]

The techniques of food-collecting actually reached their maximum importance in these latter regions. In the Mediterranean valleys and coast lands of California, the Indians collected great stores of acorns, horse-chestnuts, pine nuts, and grass seeds, which they put away in caches and took out to prepare when needed. Despite the dense population, the Indians who lived on these seeds had a relatively simple system of relations, since their habits of food acquisition required little cooperation or exchange. As a rule, each

[1] Steward, Julian H., *Basin-Plateau Aboriginal Socio-political Groups,* Bulletin No. 120, Smithsonian Institution, Bureau of American Ethnology, Washington, 1938.

village was completely independent of its neighbors, and each family collected as a unit; moreover the inhabitants of each village made a seasonal shift from summer to winter quarters, a distance of usually less than ten miles.

The Shoshonean gatherers of the dry lands of Nevada, Utah, and adjoining regions were, by contrast, thinly scattered owing to the scarcity of food, but they depended at least sixty percent in most cases on wild vegetable foods for their subsistence.[2] These foods are distributed largely by zones of altitude; from 7400 to 9000 feet is the belt of fir and spruce in which the Indians found some twenty-four species of edible grasses; from 5000 to 7000 feet is the pinyon-juniper belt, from which they derived their most important food, the pine nut. Lower down there is little in the way of food plants, except for mesquite, the screw-bean, cactus, and yucca.

In the early spring, when supplies of pine nuts and seeds were low, the Indians ate greens; in early summer, they left their winter villages to pick early ripening seeds, which had to be collected between the time of ripening and the moment of falling off their stems, and hence required rapid seasonal work; in late summer, they dug edible roots, which could be done at their leisure, and picked a few berries; in the early fall, they harvested the pine nuts. The pine nut crop is very erratic; in some years it fails completely; in others the nuts are abundant on some mountain slopes only. This means that the movements of the people who collected them were also erratic; a family would go as far as fifty miles to a place where they were abundant, and would collect at that spot with all the other families that joined them. When the pine nuts were present at all, they were so abundant that no competition was possible; the people who had wintered at the scene of the harvest welcomed the company of anyone else who wished to join them. The harvesting lasted, as a rule, for only two or three weeks, and each picker averaged twelve and a half pounds a day; thus a family of four pickers would get about twelve hundred pounds a season, if they did well. One person, living on pine nuts alone, consumes about two pounds a day, hence the twelve hundred pounds would last about four months, and the hunger felt in the early spring may be easily explained.

Since it is not easy to carry twelve hundred pounds of pine nuts about by hand, the family habitually built its winter house near the place where they had done the harvesting, and in this way different families might winter together each year. The growth and distribution of the pinyon tree, therefore, was the deciding factor in the interaction between families in this area.

[2] Steward, Julian H., op. cit.

II. HUNTING

In contrast to collecting, hunting is a definitely human activity which man does not share with his primate relatives. Whereas collecting may be done without implements, all effective hunting requires the use of weapons, traps, or both. Furthermore, collecting, as a rule, neither stimulates nor inhibits interaction; most techniques of hunting either require the cooperation of numbers of persons, or else force the hunter to operate in complete, or almost complete, isolation.

A. Implements and Forces Used in Hunting

In studying the hunting implements used by different peoples at different levels of adjustment, we find a definite evolutionary progression from simple to complex. This progression is seen both in *weapons,* which the hunter employs in person, and in *traps,* which he causes to operate in absentio.

Weapons. The simplest of the weapons ordinarily used in hunting are *clubs,* knobbed or pointed sticks, either held in the hand or thrown; and spears, which in their most rudimentary form, as in Tasmania, are made of a single piece of wood with the tip sharpened and fire-hardened. Some peoples, such as most Australians, usually cast their spears by means of the *spear thrower* (wommera, atlatl), a leverage device which lengthens the radius of the arm and gives greater distance.

The *bow,* which utilizes the elasticity of wood, and sometimes of horn and sinew as well, also makes use of the principle of leverage. Bow users do not, as a rule, do much hunting with the spear, and vice versa. Both weapons are used by peoples living on the simplest level of adjustment, as well as by others as advanced as the Romans, and the English of the sixteenth century. Some hunters, such as the Pygmies and Bushmen of Africa, poison their arrows, thus using a chemical force to render their weapons more lethal.

A complex leverage device, widely used among technically advanced peoples before the adoption of firearms, is the *crossbow,* which ejects its missile at a much greater velocity, and with a flatter trajectory and a greater impact force than is the case with a bow and arrow. The reason why the arms of the crossbow can be made so much stronger than those of a bow is that the hunter can set it by means of a ratchet, or other mechanically efficient leverage device, and release it by means of another leverage contrivance, the trigger.

Two other devices used by different peoples in hunting are the lasso, with which all readers are presumably familiar, and the bolas, a number of

stone or ivory weights, or balls, attached to the ends of thongs, or cords, which are tied together in the center. When the bolas is thrown, the weights spread out radially, and any animal hit by one or more of the weights will soon be entangled.

So far, we have mentioned devices which utilize the strength of the human arm, either directly or by means of springs and levers. There is one weapon, used by hunters in tropical forests, which utilizes a combination of human lung-power and chemical force—the *blowgun*. This weapon, developed in the tropical forests of both hemispheres, permits the hunter to shoot a poisoned dart upwards to kill birds, monkeys, and other small game in the trees. It is a specialized weapon, useful only in windless forests in environments where poison-yielding plants are to be found. Its motive force depends on the muscular power of the human lungs, but its effect, like that of the poisoned arrow, depends upon the chemical action of the poison. There are also special types of blowgun, used in Central and South America, which shoot pellets; these are, of course, much less effective than poisoned darts.

Firearms, which depend entirely upon chemical forces, have supplanted many of the weapons listed above in large areas of the world.

Traps. Traps are devices which the hunter sets and leaves to operate in his absence. Thus, by definition, none of them utilize human muscular force, except in setting them, and all traps are technically more advanced than the simplest weapons. For this reason, the simplest hunting peoples, like the Tasmanians and the Andamanese, do not use traps at all, and among those who do use them, the complexity of the mechanical principle involved is a measure of the general technological status of that people.

The simplest traps are those in which the weight of the animal himself provides the force necessary to kill, or hold, him. These include pits, sharp stakes set in the path, combinations of pits and stakes, nets into which animals run, and nooses in which they catch themselves. Traps which use other forces are deadfalls, in which a log or stone falls on the animal; box traps, in which the animal causes a door to fall when he is in a cage; and clamp traps, in which the animal releases a bent limb or piece of wood which squeezes him against a stationary unit. Further developments are set bows, set crossbows, torsion traps in which the animal releases a spiked arm which impales him, through the force of twisted sinew or other fiber; and set guns. The ultimate in traps is the modern steel trap, which has, in many parts of the world, replaced home-made devices.

The most important criterion of complexity in the development of traps is the nature of the trigger, or release mechanism, which causes the trap to operate when the animal has taken the bait, tripped over the string, etc.

Devices which utilize the weight or strength of the animal itself need no release mechanism; that is why people who live as simply as the African Pygmies and the Australians are able to make a great use of pits and nets. People like the Malay and the Chinese, on the other hand, whose general technology is much more advanced, make elaborate traps with hair-trigger release mechanisms operating through multiple levers.

B. Actions

The actions involved in hunting, aside from the actual killing of the animal, which is implicit in the character of the weapons employed, necessitate ordinarily the conditioned qualities of patience, and often technical skill of a high order, as well as physical endurance.

Tracking. Tracking, for example, requires keen observation. In some regions where the hunters are expert trackers, as in Australia and South Africa, a hunter of average tracking ability can not only tell the sex and age of an animal, as well as its species, but he can also recognize his acquaintances by their individual footprints, and tell whether they were energetic or weary, sick or well, carrying game or walking empty-handed. As an aid to tracking, many hunters, particularly in forested countries, train dogs to follow game by scent, and to make it rise or drive it toward the hunter. Some breeds, notably the sloughi or saluki, hunt by sight rather than smell.

Disguises. Many hunters use disguises to get within striking distance of animals. The South African Bushmen and the Tehuelche Indians of Patagonia make costumes which make them look like ostriches; they are able to walk into the midst of a flock and kill several before the rest of the birds take fright. In the same way, many hunters use deer antlers as a disguise, and others advance step by step, pushing a bush ahead of them, or swathed in vines to imitate an ant hill. Hunters who use disguises take advantage of the fact that animals do not, as a rule, observe objects closely which are not in motion.[3] They advance a few steps quickly, and then stand still until the next opportunity arrives. Generally they must stay on the leeward side of the animals, so that they will not be detected by smell, but with ostriches and other large birds, whose olfactory senses are limited, this is not necessary.

Lures. Luring animals is another action which helps the hunter to get close to his quarry. African Pygmies can imitate the call of a young okapi which has lost its mother so perfectly that female okapis will come crashing through the bushes into their nets; Indian and white hunters in North

[3] This is due to the lack, in most animals, of a fovea, the sensitized spot in the center of the human retina.

America are expert at luring moose by imitating the mating call of these animals. Vocal lures depend largely on these two appeals, that of the mother animal for its offspring, and that of one sex for the other in the mating season. Other lures include bait, as used in traps, and such olfactory attractions as castoreum, the secretion of a tail gland extracted from beavers, which the North American Indians used to attract many animals. Human urine also may be used as a lure for wild, or semi-wild, reindeer. Decoys are frequently used as a form of lure. Stuffed owls will frighten nesting birds out of trees; a captive eagle staked to the ground will draw other eagles. With elaborate box traps, such as those used in Indonesia, it is often necessary to tie a live goat or other animal in the trap as bait, especially when trying to catch tigers.

C. Interaction

Hunting is sometimes a technique in which each man operates alone, but more frequently it requires the interaction of groups, and the ways in which hunters interact in terms of their hunting are usually regulated by definite rules. Among the most primitive food-gatherers, such as the Tasmanians, Australians, Bushmen, and Californians, a characteristic hunting technique is the *surround,* in which whole bands, clans, or tribes, including women and children, get together and form a wide circle, and then converge, beating and shouting, until they have herded the game into a small enclosed area. At this point, certain men designated as killers step out of the circle and despatch the animals with their bows and arrows, with clubs, or with spears.

Neither the surround nor the drive require much in the way of special weapons or elaborate actions, but they do require leadership and planning. In Nevada, the Shoshoni Indians conduct a drive only when a special leader who is supposed to have special spiritual power is present to organize it; he has to get the people of many camps to come together and to follow his directions. An example of this is the Deep Creek Gosiute antelope drive,[4] described by Egan:

> For a few days before I came, the squaws and bucks were busy repairing and extending the flanking arms of the old corral, or trap pen, which was located near the north end of Antelope Valley and about 20 miles northwest of Deep Creek. It was pretty cold weather, but no snow on the ground. The Indians thought it a good time and expected a good catch.
>
> After they had all come in from their work, a great deal of talking and planning was on, and each knew just what part and place he or she was to

[4] Steward, Julian H., op. cit., pp. 34-35; Egan, Major Howard R., *Pioneering in the West, 1846 to 1878,* William M. Egan, Editor, Salt Lake City, 1917, pp. 238-241.

take. By daylight all were ready for the start, and, in fact, a number of the young men had left the evening before to go to the extreme south end of the ground to be covered and about 20 miles from the pen. They were to spread apart across the valley, travel in open order back to the north, being careful that not one of the antelope jumped would run, except in a northerly direction. . . .

An antelope, when started up, will always run directly for one of these (knolls), that lie opposite from where he gets his scare from, and they run from hill to hill. They see no one ahead of them, but the party behind is being constantly increased, and if they undertake to pass around the drivers, a buck or squaw is sure to rise to his feet, and that sends them off to the center again.

Thus it goes till they come to the line between the outer ends of the arms, which, there, are about 4 miles apart, but gradually closing in as they get nearer the pen. The arms or leads are started at the extreme ends by simply prying or pulling up a large sagebrush and standing its roots up on the top of another brush, thus making a tall black object visible for miles. The standing of these brush were at first some 10 to 20 feet apart, but were placed more and more near together the nearer towards the pen, and when the two lines came to about 100 yards apart, they were built so the butts of the brush were as close as the tops would allow them to be joined, and by this time both wings had swung to the east side of the valley, where there were many ravines to cross and plenty of cedar and pine for fencing.

There were many turns to the lane thus formed, but (it) was getting narrower and stronger until finally, around a sharp turn through a large, thick bunch of cedars, the game were in the corral, which was about 200 feet in diameter and built strong enough and high enough to withstand a herd of buffalo. The pine and cedar trees had not been removed from the inside of the pen, and not many from the runway, for a mile back. . . .

The drivers . . . were all on a fast run, yelling like a pack of coyotes. The drive came to an end with a rush, and everyone working desperately closing up the entrance. . . .

Then began the killing of as many as were wanted that day, the killing was done with arrow and seldom missed the heart. The catch was about 25, mostly all bucks or does. . . . There were five or six killed that day . . . to give the squaws time to cut in thin strips the flesh and dry it on a rack built over a small fire, thus curing it so it would keep for a long time if kept dry. . . .

Three or four young men (had been left) to guard the place. By the next morning, the antelope had run themselves down and were huddled in the center of the enclosure. . . . The Indians picked out five or six of the largest, which were killed. . . .

The Indians told me that the last drive, before this one at this place, was nearly 12 years ago and the men never expected to see another at this place, for it would take many years for the animals to increase in sufficient numbers to

make it pay to drive. These drives are mostly in the desert valleys, where the poor horseless natives live.

In certain environments, the habits of the principal food animals make drives of this sort, which require coordinated interaction of many individuals, unnecessary. In boreal forest climates, for example, where large herds of animals make seasonal migrations over the same routes each year, hunters build long fences set at an angle to the migration path, and control the movements of the animals in this way. Both the American Indians of the northern forests, and the natives of Siberia, employ this technique with caribou and wild reindeer. The Athabascan Indians set nooses along these posts, which catch many of the caribou by the horns or necks; at the end of the fence, or at the bottleneck between two fences, men are stationed to club or spear the animals as they try to squeeze through. In Siberia, the Yukaghir sit in the middle of a stream in canoes and spear the reindeer as they swim by. It is claimed that one man can spear as many as a hundred in an hour. These techniques of mass slaughter do not require driving and beating since the animals walk or swim to their place of destruction of their own volition.

A method of hunting which requires a maximum of timed interaction between a few people is the technique of deer driving practiced by the Seri Indians of northwestern Mexico. From three to five men go out together; when they find the tracks of a deer, they follow these until they are near the animal, and then they separate to either side. After they have located it, they spread out, and then one man rushes up toward it. The deer dashes away from him, and when it has gone a certain distance, a second man, who has been watching this closely, pops up behind a bush, frightening the deer again and making him turn in the opposite direction. The men race from bush to bush to be in the proper position each time the deer approaches them, and in this way they make it zig-zag for miles until it is exhausted. At this point, the men, who have covered much less distance than the deer, run up to it, and one of the men clubs it to death with a stone.

Hunters who travel on horseback, i.e., hunters who use animal power for transportation instead of human muscular power only, can cover much more ground and feed off a wider territory than those who hunt on foot. In this way, the size of the group living together can be larger than in the case of foot hunters, although a given landscape cannot support more persons per square mile by the one technique than by the other. In Siberia, the Northern Tungus, who ride reindeer, can cover a range of as much as fifty miles a day hunting wild reindeer and tending their trap lines; the advantage of this is that they are able to keep their families in permanent camps all winter.

On the American plains, the Omaha, Dakota, Crow, and other tribes

were able to live in large camps, from which they hunted buffalo on horseback. The use of the horse gave them mobility, and also permitted large numbers of people to hunt at one time; these people were able to specialize in terms of hunting. The hunt itself was a form of surround, in which horsemen rode round and round the buffalo herd, making it mill together, so that they could shoot into the midst of the animals and slaughter them in great numbers. A hunt of this type took much planning and organization; there had to be a leader whose orders would be obeyed, and he had a special police force to see that they were carried out. Then there were the actual hunters, who milled the herd and shot into it, and the meat cutters, who came in afterward, flayed the carcasses and cut the meat up into pieces that could be carried to camp on horseback and made into jerkie.

It can be easily understood why this specialization was necessary. The police had to keep individuals from disturbing the herd before the signal was given, lest the animals scatter and run away; the hunters had to be men who owned or could obtain horses, who were good riders and strong bowmen, and who could work together at a signal. They had to keep in line, so that there would be no gaps in the circle, and they had to control their horses to keep them from getting out of hand when frightened by the buffalo. They had to be able to pull a strong bow, since a buffalo is a large animal with a tough skin and heavy muscles to penetrate. The meat cutters were men who did not own horses, and who had developed special skill in rapid butchering.

The Limitations of the Hunting Technique for Interaction. Trapping, by its very nature, limits interaction within the group to a minimum. In regions where trapping is done on a large scale or commercial basis, as in Canada and Siberia, it is not uncommon for two men to go into partnership, spending the entire winter season away from home, helping each other with their trap lines and with the camp-making and cooking. This system is especially useful in regions where part of the travel is by water before the rivers and lakes freeze, because two men are much better than one in a canoe. The chief reason is, however, that individuals with normal personalities do not like to spend months at a time all alone; if they do, they are liable to become mentally deranged.

The elaboration of mechanical devices has not increased the cooperative aspect of hunting; if anything, it has done the reverse. A man with a rifle usually hunts alone; one shot will frighten the game, and two men might shoot each other. Only when game comes in vast herds, as in the case of the American buffalo, can cooperative hunting with rifles be profitable.

Hunting and Population Density. Land hunting, owing to its dependence on the numbers of wild animals present in a given landscape, is not a technique by which a large population can be supported per square mile, even in the best of environments. No matter how involved the interaction may be between the hunters, as in the case of the surround, the antelope drive, or the Plains buffalo hunt, the number of individuals who interact in these enterprises must necessarily remain small, since the scarcity of food keeps them scattered. Most hunting techniques actually inhibit interaction rather than foster it. Therefore, the rule can be formulated that the more time a given people devote to the techniques of hunting, the less they are able to interact with each other; and the less time they spend in hunting, the more they interact. Complex or commercial civilizations do not develop on the basis of hunting techniques alone; this is due not to any mysterious quality of the hunting technique itself, but simply to the relative inefficiency of this method of obtaining food from the landscape.

Sea-Hunting, or Harpooning. A variant of hunting is the category of techniques known as sea-hunting, or harpooning. This is a specialized set of techniques used only in a few areas, especially in the polar seas, where seals, walruses, white whales, whales, etc., are killed, and in the tropical seas, where dugongs, sea-turtles and large fish are the chief prey.

The instruments used in harpooning are very much the same everywhere; the harpoon itself is a shaft with a detachable head, and it is made fast to the harpooner, his boat, or floats, by a cord. After the harpooner has struck the animal, the shaft floats loose while its head stays in the animal's body. Except in modern commercial whaling, the force used everywhere is only the force of the harpooner's arm. The basic action is simply casting the harpoon, an act which requires both strength and skill. This action may be performed by the harpooner all alone, or it may be made possible only by a complex set of interactions between a number of closely coordinated individuals.

Let us study briefly a few examples of harpooning, the techniques practiced by the Polar Eskimo, who live on the shore of Smith Sound in northern Greenland.[5]

> The sea-hunting naturally falls into two forms; hunting on the ice, and hunting on the open sea. . . .
>
> When the ice first forms, before the snow covers it deep and hides the breathing holes of the seal, the hunters busy themselves on the ice, hunting the

[5] Ekblaw, W. Elmer, "The Material Response of the Polar Eskimo to Their Far Arctic Environment," *Annals* of the Assn. of American Geographers, Vol. XVII, No. 4, 1927, pp. 148-198, and Vol. XVIII, No. 1, March 1928, pp. 1-24.

seals that are then fat and in prime condition. The hunter dons overshoes or sandals of bearskin in which he can walk noiselessly over the ice seeking the breathing holes. When he finds one, he waits quietly until the seal comes up to breathe, when he harpoons it swiftly and securely. . . .

The most productive seal-hunting, the so-called *utoḳ* hunting, begins late in April or early May when the seals come up through holes in the ice to bask in the warm sunshine. An utok is an animal lying on the ice. This hunting lasts as long as the ice is safe, and yields a rich store of meat. Only on calm, clear days is *utoḳ* hunting practicable, but fortunately these days prevail during the spring and early summer.

The Eskimo sledges as near the basking seal as he deems wise. He then enjoins the dogs to keep their places, and stalks the seal behind a small white sail mounted upon a diminutive sledge, of which the runners are shod with strips of bearskin. The rifle is also mounted upon the little sledge with only the muzzle protruding before it. While still at some distance from the seal, he advances cautiously but rapidly, crouching behind the sail when the seal seems reassured. As he approaches near the seal, he crawls up on his hands and knees behind the sail until he comes within easy range, or until the seal becomes so uneasy that a nearer approach might frighten it down through the hole. Then taking careful aim, he fires. He runs forward immediately to seize the seal and drag it away from the hole to prevent its escape should it be merely wounded or temporarily disabled.

The dogs in the meanwhile have watched the stalking carefully, all intent upon the outcome. The minute the smoke flashes from the muzzle, even before the sound of the shot reaches them, they race off to the kill. They are apparently as elated as the hunter when he is successful, and as discouraged when the seal escapes.

Besides seal, the Polar Eskimo hunt both walrus and polar bear on the ice. During the season, which lasts from the middle of February until late in May, from the time when the sun reappears after its winter absence until the beginning of the break-up of the ice, most of the Polar Eskimo assemble at the mussel shoals off Cape Chalon and Cape Saumarez, where the walrus are abundant.

For this season almost all the hunters from Cape York to Etah are wont to come to these hunting grounds, bringing their families with them. Not nearly enough igloos [stone houses] are available to accommodate the tribe, and so most of the visitors live in iglooyaks [snow houses] substantially built.

It is a time of feasting and merriment and good fellowship, for practically the whole tribe is then assembled and food is abundant. Only very rarely does this hunt fail. In ordinary seasons the hunters kill more walrus in half a day's hunting than they can cut up, haul to shore, and cache under rocks in two or

three days. When the weather is calm and clear, and the ice smooth and unbroken, the hunters may be scattered all along the horizon, a group here eagerly awaiting a kill; another group there hauling a huge carcass upon the ice, still another cutting up great blocks of meat elsewhere, and others just as actively engaged as far as the eye can see. Heaps of meat and blubber dot the ice, and sledges busily ply to and fro between them and the shore drawing the precious stores to solid land, where they may be kept accessible and safe.

In no instance is the ingenuity of the Eskimo more clearly indicated than in the block and tackle system he arranges in the ice to draw the heavy carcass out of the water. Three pairs of holes, sometimes four, are cut in the top part of the ice and an equal number in the tough skin of the walrus, and the harpoon line is passed through them back and forth, so that at least six members of the falls sustain the weight and give the multiplied leverage required. By this block and tackle system, usually with the help of companions, but sometimes alone, he draws his heavy quarry up the ice.

Hunting animals in the open sea requires the use of the kayak, the skin-covered boat in which the Eskimo navigate singly with the aid of double-bladed paddles.

The equipment necessary for kayak hunting is extensive. . . . A harpoon must be carried, for since most of the game would be lost if it were merely shot, most of it is harpooned first. To prevent its escape when harpooned, a line, a float, and a drag are necessary. To kill it, the killing iron and the rifle, sometimes both, are necessary. Beyond these impedimenta, the kayak cannot carry any but minor things—a few matches, a needle-case, some tobacco perhaps. The range of kayak hunting, then, is somewhat restricted.

From the kayak, the Polar Eskimo hunt four species of seal, walrus, narwhal, beluga, and a few birds. They do this in the summertime and quit before the new ice forms in September, since the sharp edges of the new ice would cut the skins of the kayak to pieces. They do all of this hunting singly; there is no need for interaction, since each man has a canoe of his own and several men together would, under normal circumstances, frighten the animals away.

Hunting walrus from a kayak is the most dangerous of all hunting in which the Polar Eskimo engages. When one walrus of a herd is wounded or killed, the others are likely to attack, and then the hunter must most dextrously avoid being caught. The walrus are inevitably harpooned, whether swimming in the open water, or sleeping on ice cakes. The same harpoon point used in hunting from the ice is employed, but the line is attached to a large inflated float made from the entire skin of a large seal, well tanned and well sewed. This large float retards the flight of the wounded animal, indicates his course, and keeps

him from sinking or being lost when killed. Often a large, square drag, made of sealskin stretched over a bone or wooden frame, is also attached to the harpoon line, further to retard the animal's flight.

When the walrus are killed in the open sea, they must be towed to shore at some place where the slope is so gentle that the huge carcasses may be pulled far in on the high tide. When the tide ebbs, they are left near the high tide limit, to facilitate storing the great heavy slabs of meat and blubber in which the carcass is cut. . . . The work of carving up a three-thousand-pound walrus, and caching the meat under sufficient rocks to keep it safe, is no light task, and occupies several busy hours.

From these accounts it may be seen that the sea-hunting techniques of the Polar Eskimo, which provide them with the bulk of their food and other materials, are essentially individual techniques involving the single hunter alone. We see that in some cases interaction is definitely inhibited by these techniques, while interaction is useful, but not necessary, in the secondary activities of hauling the animals ashore and cutting up their carcasses. As in the case of the Plains Indians, the Eskimo are able to extend their range of hunting by the use of advanced means of transportation, in their case the dog-sled and kayak. On the whole, the Eskimo may serve as an example of a people who have developed advanced mechanical techniques, but who have been prevented from becoming specialists or from developing elaborate types of interaction because the environment to which the techniques are adapted inhibits interaction at even this technical level.

Interaction is, however, essential in the types of sea-hunting which require more than one person in a boat. Among the Andaman Islanders, a people who hunt sea-turtle and dugong, the canoe has a platform at the bow, on which the harpooner stands. Two other men paddle, while the harpooner watches for signs of the animals, and directs his companions to paddle gently and noiselessly towards them. When they have arrived within casting distance, he throws his harpoon with such force that he himself falls overboard. The men in the canoe handle the line while he swims back aboard.

The Miskito Indians of Honduras[6] harpoon large fish, manatee, and turtle in more or less the same way. The harpooner, who sits in the bow, signals the paddler or paddlers behind him by quivering; the number and intensity of the quivers tell the others when to advance, when to stop, and which direction to follow. When they have harpooned their prey and drawn it in dead or exhausted, they swamp the canoe to force it under the animal; then they bail it to lift him out of the water before paddling

[6] Conzemius, E., "Ethnographical Survey of the Miskito and Sumu Indians of Honduras and Nicaragua," Bulletin 106, Smithsonian Institution. Washington, 1932

home. The Andamanese practice this same method of taking the animal on board.

Whaling. The technique of whaling, wherever practiced, requires a great deal of timed interaction, since a whale is a large animal and it takes many people working together to maneuver it aboard ship or onto shore, and to cut it up. On the old New Bedford whalers, the crew was divided into specialists of several types; these included boat-steerers, helmsmen, and oarsmen, as well as the ship's navigating officers, cook, etc. In each whale-boat which put out over the vessel's side, was one officer, who was one of the ship's mates, a "boat-steerer," and a crew of four oarsmen. The "boat-steerer," who was actually the harpooner, stood in the bow with his harpoons; [7] the officer was at the stern, with his hand on the steering oar if the crew was rowing, or on the tiller if they were under sail. When the boat approached a whale during a dead calm, the crew would be ordered to ship their oars in-board and move the boat forward quietly with their canoe paddles. At the right moment the "boat-steerer" cast a harpoon; he had to cast another immediately, before the whale "sounded" or sank below the surface, as the two harpoons were both attached to the same line. After the whale "sounded," the officer left the steering oar, or tiller, and went forward, while the "boat-steerer" went aft to replace him during the rest of the operation, which was the most dangerous part, as the whale might attack and capsize the boat. If it was a large sperm whale it might attack the whale ship, and ships have been sunk in such attacks. The officer's job was to see that the line was drawn in so that the boat would be near enough the whale when it rose for air; he could then try to kill it with lances or a shoulder gun. He often speared it with several lances and shot several charges into it before it died. After it had been killed the boat's crew rowed, or sailed, back to the ship and handed the line aboard; the crew as a whole hauled the whale alongside and flensed it on a scaffolding. The operations involved in handling the carcass, flensing it, and boiling the blubber were in themselves not complex; what is important is the division of labor and timed interaction between the members of the crew.

In this technique of whale-catching, we have seen that the officer originates action to the others, while the "boat-steerer" acts as a professional in two operations, harpooning and steering. There are thus three different kinds of action performed habitually by three groups of people, and in each vessel there are a number of such boat crews, and other specialists as well. Since

[7] This is a verbatim account from a New Bedford harpooner of the period 1890-1900 ca.; in earlier times, according to Melville, the harpooner had also to row one of the bow-oars.

whaling is such a specialized technique it is not surprising that only a few peoples in the world have mastered it.

III. FISHING

The subject of fishing, like that of hunting, can best be treated by a separate examination of the *implements and forces,* and *actions* and *interactions* involved.

Implements and Forces Used in Fishing. The mechanical devices by which fish are taken from the water are relatively few in number. Cordage is important in most of them; one of the simplest devices is the cord with a baited knot or snarl on the end, with which the Yaghans of Tierra del Fuego bob for fish from their boats. The fish gorge, a double-ended skewer used in many parts of the world, is probably, in the developmental sense, the predecessor of the hook, which is widely used but by no means universally. An even commoner device is the fish spear, usually double pronged. Almost everyone who fishes at all, except in our civilization, uses the spear. Some peoples also fish with the bow, using multi-pronged or barbed arrows.

Fish traps in many respects parallel those employed for catching animals, but as a rule they are simpler. Many peoples build dams, weirs, pounds, and mazes in rivers, on the principle that the fish will be guided by the direction of the waterflow into an enclosed area from which it cannot escape. Some peoples use nets in conjunction with dams, and others employ them separately. Fish traps, apart from nets, are usually made of basketry, and operate on the principle that a fish can push apart flexible converging units of wood slivers or bamboo so as to enter an enclosure containing food, but it cannot push them apart again to get out. Entrances to fish-traps, so arranged, are known as fish valves. Other traps employ the principle of engaging the fish's scales, which all point in one direction. The elaborate release mechanisms of land traps are not needed in fish traps, and hence are seldom used; furthermore the only forces used are the weight and swimming power of the fish themselves.

There is a considerable range in the complexity of fish nets; the simplest are hand dip nets, which the single fisherman operates in a stream or offshore, and the circular casting net, which has weights around the edge and spreads when thrown like a bolas. Other kinds of nets require the efforts of a number of persons to handle them; these are usually large nets, such as seines, which must be spread *around* a school of fish, with floats on the upper border to hold it to the surface, and sinkers on the lower border to keep it in a vertical position.

One other device used frequently in fishing is poison. It is most common

in tropical regions, for warm water is necessary if it is to be effective. The poison is usually obtained from tree bark, which is crushed and thrown into a relatively small and still body of water. Most fish poisons act as irritants, forcing the fish to leap out of the water, and finally to float unconscious on the surface. By using poison, people are able to gather large numbers of fish at one time.

Actions and Interactions. The specific actions necessary in fishing are not, as a rule, very numerous or elaborate, and most of them require less skill than those employed by the hunter. A fish is not as cunning an adversary as a mammal. Furthermore, fish go in schools, while mammals are more likely to be encountered alone. Fishing, therefore, more often takes on the aspect of a group activity than is the case with hunting.

One of the simplest sequences of actions which a fisherman can perform is to bait his hook, throw it into the water, and pull in the line when the fish bites. This is done in all cultures. The man who spears fish or shoots them with a bow and arrow must know how to cast or shoot his missile in such a way that he can allow for the angle of refraction in the water, for unless he is directly over the fish, its position is not where it seems to be. The man who casts a circular net must be able to judge distance and velocity and must know exactly when to cast, so as to enclose as many fish in his net as possible.

So far the techniques of fishing are simple operations which are performed individually. Even on a Grand Banks fishing vessel where hand lines are used, the only interaction necessary is that connected with transportation to and from the fishing grounds, disposing of the catch, etc., and not with the actual fishing. When it comes to large nets, however, and especially seines, much coordinated effort is necessary. The seining crew, like that of a whaleboat, must have oarsmen and a helmsman, someone to guide the boats in setting the net and men to do the rowing in response to orders. The actions of the school of fish, like those of a herd of buffalo, impose the necessity of accurate *timing*. A good illustration of the use of a seine net may be taken from an account of Maori fishing.[8]

A brief description of the spectacular fishing display made by a chief, Te Pokiha, with his great net in 1886 . . . illustrates the manner of organization of such an important enterprise. The net used in this affair was a huge one, measuring by veracious report, 95 chains (6270 feet) in length. It was made at Maketu during the winter months of 1885, by several hundred of Ngati-Pikiao

[8] Mair, G., *Reminiscences and Maori Stories,* condensed and paraphrased by Firth, R., in *Primitive Economics of the New Zealand Maori,* New York, 1929, E. P. Dutton & Co., pp. 214-215.

of Arawa, on the initiative of their chief Te Pokiha Taranui. The net was taken in sections to a flat below the village and was there set up with appropriate magic by the learned old men of the tribe. It was of such a size that no single canoe would hold it, and it was therefore taken out on a platform, placed over two war canoes lashed together, the whole thing being propelled by thirty men. The control of the enterprise was in the hands of one Te Whanerere, an expert in fishing, who in order best to supervise the workers, ascended to the top of a high telegraph tower near by, and thence gave out his commands. Shoal after shoal of fish he allowed to pass untouched, while crew and waiting crowd grew impatient, but the old man was wise in the lore of fish and nets. At last he gave the signal to encircle what appeared to be an insignificant brown patch on the water. "Haukotia mai!" came his cry. "Intercept it!" The paddles dipped furiously, the craft forged along, and the net was payed out by six men. After the shoal was encircled, a great portion of the net was still unused, but nevertheless it was found impossible to haul the seine, in spite of the large number of people who hauled on the ropes. The catch was too great. The unused part of the net was now doubled round the remainder, and the expert came down from the tower and swam out to attend to the work. Under his direction the men hoisted the belly of the net, and so allowed a large part of the catch to escape. This was done twice, and only then could the seine be hauled in to the beach. It was held there by stakes driven firmly in, and the tide allowed to fall. . . . The resulting catch numbered many thousands of fish, and its apportionment was supervised by Te Pokiha himself.

This illustration shows the different functions performed by those who took part in the work—the makers of the net, the paddlers of the canoes, the six men who payed out the net, the people on shore who lent a hand in hauling it up, and the expert whose business it was to direct and supervise the operation. Then, finally, in the leading role, as giving the initiative and stimulus to the whole enterprise was the chief himself, whose prestige the affair helped greatly to enhance all along the coast.

The incident described above is as complex an example of a fishing technique, from the standpoint of interaction, as one could find anywhere. Nevertheless the force used throughout the whole operation was that of the human muscles. In modern seine fishing, this is supplemented by power-driven winches to pull in and lift the seines, to bring the fish aboard ship, so that a catch like that of Te Whanerere is a routine affair. Furthermore, modern fishermen spend weeks at a time at the fishing grounds; the ships that go out of Gloucester and Boston to the Grand Banks meet there hundreds of other ships from Canada, Newfoundland, Portugal, Spain, and other countries, which come out under engine or sail, and are supplied by small steamers which also take away some of their catch. Efficient transportation, therefore, makes it possible for elaborate fishing to be practiced by full-time

specialists, who supply an important element of diet to large populations. The huge populations of China, Japan, and India likewise depend on salt-water fish to eat with their rice and wheat.

Inland Fishing vs. Sea Fishing. Inland fishing on ponds and streams is subject to the same environmental limitations as hunting. It can support but small populations per square mile, since the supply of fish is easily exhausted, except on huge bodies of inland water like the Great Lakes, where the situation is similar to that on the sea.

Salt-water fishing, however, is much less subject to these limitations. Even where people fish from the land or near the shore, it is very difficult for them to exhaust the food supply; when efficient sea transport is available, even this possibility is avoided. Unlike hunting and inland fishing, therefore, sea fishing can draw upon a seemingly limitless supply, and in such cases as that of the seasonal salmon runs on the Northwest Coast, enormous numbers of fish are concentrated in a small area at definite seasons and can be easily gathered.

IV. MINERAL EXTRACTION (INCLUDING MINING)

So far we have considered the methods employed by people on different levels of adjustment, in the acquisition of animal and vegetable materials to be used primarily for food; in this section we shall consider the techniques which they employ in extracting, or acquiring, mineral substances, none of which, with the exception of water and salt, are ordinarily eaten. There is a fundamental difference between collecting, hunting, and fishing, on the one hand, and mineral extraction, on the other. In the former case, the animals and plants hunted and gathered reproduce naturally, and if the species are not exploited to the degree of extinction, a given area can yield animals, wild plants, trees, etc., over and over again, as the sea can continue to yield fish. Minerals, however, are exhaustible; with the exception of water, once they have been removed from the earth they cannot be replaced. Thus the exhaustion of minerals in a given landscape may be of importance in producing changes in the adjustments of the people who live there.

The various techniques of mineral extraction practiced by human beings may be divided into (1) Simple Extraction, (2) Mining and Quarrying, (3) Evaporation, and (4) Well-Digging, Drilling or Boring.

1. Simple Extraction. Most people who live by gathering techniques alone, and on a subsistence basis, practice no mining, quarrying, or other complex techniques of obtaining minerals: they acquire them by the same techniques as those employed in *collecting;* that is, they dip water out of streams, pick up flint nodules from the ground or pry them out of banks

with digging sticks, and dig clay and ocher with the same sticks or with hoes.

These are all simple operations which require no implements other than a digging stick or hoe, no force other than the human arm, and no cooperation between individuals; the only factor which makes them at all difficult is that the minerals extracted do not, as a rule, occur widely, and special trips must be made to the stream, water hole, clay bank, or chalky flint bed to get them.

2. Mining and Quarrying. Mining and quarrying, on the other hand, are techniques which imply, as a rule, some degree of specialization and trade. An example of the latter is the quarrying of ax-stone by the inhabitants of the Jimi Valley in the Mount Hagen region of New Guinea.[9]

These people make polished axes from stone which they extract from two quarries in their territory. The first quarry consists of a bank cut into a hillside, in which loose stones, roughly a cubic foot in size, are embedded in earth. The villagers who live near by have deflected a small stream so that it runs over the bank and washes the dirt off the stones, making them visible. The second quarry is a shaft thirty feet deep in which they break off pieces of diorite with stone hammers. The diorite occurs in the form of a sill between strata of shales; the workmen have cut through the overlying shale to get at the diorite, and have shored up the pit with logs to prevent cave-ins. All of the men in this tribe know how to mine stones, and all of them use these two mines, each man working separately as occasion demands, quarrying the stone, grinding axes from it, and trading them. Their axes are found over wide areas of New Guinea.

Another example of mining under simple conditions is the prehistoric and early historic coal mining of the Hopi Indians of Arizona.[10] The modern and ancient Hopi villages and village sites are located on the edge of the Black Mesa. This mesa

> is underlain by the Mesaverde formation, composed of interbedded sandstone, shale, and coal. The Jeddito Valley ruins . . . are . . . located on the southern edge of the Black Mesa, so that coal-bearing rocks crop out on the mesa edge below the ruins. Here the coal occurs principally in one large seam which varies from a foot and a half to six feet in thickness. Below the ruin of Awatovi, another seam was found about forty feet above this large seam. It is six inches to a foot thick. . . . The coal seams are located on a wide sloping bench about halfway down the mesa edge, and are easily accessible. . . .

[9] Vial, L. G., "Stone Axes of Mount Hagen, New Guinea," *Oceania,* Vol. XI, No. 2, Dec. 1940, pp. 159-163.

[10] Brew, J. O., and Hack, J. T., "Prehistoric Use of Coal by Indians of Northern Arizona," *Plateau,* Vol. 12, No. 1, 1939.

In the Jeddito Valley, the method of mining most commonly used was a method known in modern mining as "stripping" or "strip-mining." The coal crops out on the bench halfway up the cliff or valley wall. Mining begins by simply quarrying the coal. The waste material, consisting mostly of impurities in the coal, is discarded and forms small piles of debris at the foot of the original outcrop of the coal. As quarrying continues, the point is soon reached where because of the slope of the valley wall, the coal seam becomes covered by the next overlying bed of rock which in mining practice is referred to as the overburden. In the Jeddito Valley, this usually is sandstone, which, if more coal is to be mined, must be removed and discarded. The overburden, being of hard sandstone, is broken up and piled behind the miner, together with the discarded fragments of the impurities in the coal. Thus the miner really works in a sort of open trench, parallel to the hill slope, with piles of mining waste behind him and the rock face in front of him. As mining continues and this trench advances the overburden becomes increasingly thicker, and the piles of waste become higher and higher. Likewise mining becomes more and more laborious. . . .

When the overburden above the coal becomes too thick to be removed, the miners had a choice of either starting a mine somewhere else, or undermining the sandstone overburden, and using a method of underground mining. An underground mine was located near Awatovi and a portion of it was re-excavated. In this mine, the miners had simply undermined the overburden, and when danger of collapse occurred, they had supported it with waste material, and with sandstone blocks piled up like bricks. The coal face was found fourteen feet in from the place where undermining had begun. . . .

Some evidence of the type of mining tools used has been found. A large, heavy, quartzite hammerstone was found in an ancient strip mine near Jeddito. Also numerous pottery fragments were found which showed evidence of having been used as scraping tools. Mining was probably done mostly by picking and hammering. But hammering could not be easily done in an underground mine, since the working space was very small and cramped; hence picking was probably used. The removal of coal was made easier by the weight of the overburden, which probably caused it to spill off. But, however actually mined, the process must have been slow and laborious, and it seems likely that it was probably sporadic.

The prehistoric and early historic Hopi used this coal mostly in firing pottery, as abundant kiln remains testify. As in the case of the Jimi Valley people in New Guinea, they came to this mine individually when they wanted coal, and took it as they needed it, by purely hand methods. With the coal they fired great quantities of two special and easily recognized pottery wares, Jeddito Black and Sitiyatki, which they traded all over the Southwest, and they also heated in winter the rooms where they wove a cotton

cloth which was widely traded. Thus the presence of a vein of coal which the Hopi could mine by individual hand methods permitted them to build up a surplus of manufactured materials.

The techniques of quarrying stone for use as lamps, vessels, tobacco pipes, and building blocks have also been practiced in many parts of the world. For example, the Eskimo of the whole Arctic Ocean coastline of the New World traveled sometimes as far as a thousand miles to carve lamps and cooking vessels from soapstone outcrops; the New England Indians likewise obtained this material at a few special places, one of which still remains at Providence, Rhode Island. The aboriginal American soapstone-cutters hollowed their vessels with stone picks and hammers on the ledge, and then removed the stone around them, after which they undercut and broke the half-finished container loose from the ledge. The soapstone quarry at Providence contains a number of half-finished bowls still in place. In Minnesota, there is a famous quarry of catlinite, or red pipe-stone, to which Indians came from long distances; all of the red-stone calumets, or peace pipes, used by the Plains Indians came directly from this one site.

It is interesting to observe the quarrying techniques used by the Indians of Central and South America who built imposing temples and palaces of well-hewn stone; this was done, for the most part, with simple stone hammers and picks. Holmes[11] discovered, for example, a quarry outside the city of Mitla, in the state of Oaxaca, Mexico, from which came the building material used in that architecturally remarkable site. Excerpts from his account follow:

> The stone used by these builders for facing their walls within and without, for the great lintels and door jambs, for pillars, stairways, columns, and ceiling stones, is a variety of volcanic lava known as trachyte. It is a massive light gray rock of moderate density and hardness, but reasonably tough and durable, and easily split and hewn. It is the main constituent of the mountain masses that surround and overlook Mitla, and outcrops in the bluffs and higher cliffs on all hands. Where the compact lava flows overlie rocks of less durability, they are undermined at the margins and break down of their own weight, leaving the fresh surface exposed and in many places visible from the valley. The huge detached masses, more or less rounded by weathering, lie along the precipice base and scattered down the slopes.
>
> The builders of Mitla sought and used not only these convenient masses, but went much farther and attacked the solid rock in place, cutting it out in large masses which were transported long distances over rough country. . . .

[11] Holmes, W. H., "Archaeological Studies Among the Ancient Cities of Mexico," Field Columbian Museum, Publication 8, Chicago, 1895, pp. 279-285.

> Mr. E. H. Thompson . . . visited the high mountain quarries known to the present natives of Mitla . . . nearly a thousand feet above the village and at least six miles away. About it were several large blocks, already removed from their beds, while others had been left partly cut out or only outlined. The work had been undertaken on the sloping surface of a solid mass of the trachyte. Channels had been cut the full length of the blocks desired and to the proper depth, and likewise across the ends; when these were widened sufficiently, undercutting was begun and carried on until the mass was severed and could be broken off by the aid of levers or wedges of wood, possibly aided by water. After the removal of one block, the amount of cutting for each stone was reduced somewhat, as one side only, instead of two, had to be channeled. The channels observed were a foot or more wide and the depth was about three feet at the deepest. . . . The stone at the right has been removed and set on edge; the next one is free and blocked up on small stones; the third is well undercut and the fourth is channeled nearly to the full depth.
>
> The larger blocks among the half-dozen wholly removed and set on edge are 12 feet or more in length by 5 or 6 wide, and from 2½ to 3 feet thick. Such a stone would weigh perhaps 15 tons.

The stonecutters of Mitla did their work without metal tools; they used only crude stone hammers and picks, held in the hand; many of these tools remain in the quarry. The actions were simple and laborious, but required considerable planning and skill; it is apparent that a planned organization, with directors and workmen, was necessary to operate the quarry. Probably the stonecutters were part-time or even full-time specialists. In transporting the stones from the mountain slopes to the city, they had no force at their command other than that of human muscle, aided by whatever leverage devices they could employ.

From the foregoing examples it is apparent that people who employ simple, non-metallic tools and hand-labor alone, are able to conduct mining and quarrying operations of considerable complexity, and on a moderately large scale.

Advanced, commercial miners and quarrymen, however, whether they extract ores, salt, coal, or stone, always use metal tools and such advanced mechanical devices as blocks and tackles, shears, elevators, dump carts running on tracks, and the like; and these devices are usually operated by animal power or by steam, gasoline, or electricity. Only by the use of advanced mechanical devices and abundant sources of power is it possible for workmen to produce a large quantity of minerals per man-hour of work, and to supply the large demand for these materials by people living in technologically complex civilizations.

Like commercial sea-fishing and lumbering, which are also advanced gathering techniques, commercial mining involves a complex pattern of interaction; the mining company is organized into a hierarchy of officials, foremen, and workmen performing different kinds of tasks, who must all coordinate their special techniques if the enterprise is to be successful. Mining is comparable in this sense to manufacturing.

3. Evaporation. Evaporation is the commonest technique used in the extraction of salt, either from sea water or from the water of saline springs. Most of the peoples who live largely by hunting have no use for salt, since it occurs in sufficient quantity in their foods. Agriculturalists, however, need it, just as herbivorous animals do; to obtain it they perform two principal operations.

The first is to burn wood, preferably of a highly saline type, then to dissolve the salt in the ashes in water, and finally to evaporate the water by fire, leaving the salt in crystalline form. This technique is employed principally by agriculturalists living in tropical forests in both hemispheres.

The second is simply to evaporate sea water or water from saline springs. In some parts of the Sahara Desert, for example, where salt springs are common, the salt workers lead the water into shallow tanks, where the heat of the sun does the rest. In Aden, where, owing to the extreme heat the sea water is highly saline, water is pumped by windmills into drying tanks covering several acres. In both these examples the salt evaporation is the work of the sun, in extremely hot and usually cloudless regions; in other environments people evaporate the water by means of fire, as in the first technique—in Bohemia, for example.

Salt, like most other minerals, cannot be extracted everywhere; for this reason it is often one of the most important articles of trade among agricultural peoples. In parts of Negro Africa it is even used for money. In prehistoric Europe the most important trade routes were those over which salt was transported from its sources of supply to the regions where it was consumed.

4. Well-Digging, Drilling, and Boring. As we have previously stated, most people living at a simple level of culture obtain water by dipping it from streams, springs, or lakes, in ordinary containers. This technique limits their geographical range of action to the neighborhood of water sources, and most of their settlements are located near one. In dry environments, however, such sources of water are few and far between. A knowledge of well-digging, however, greatly enlarges the amount of available water and permits people to live in an otherwise uninhabitable region.

In Australia, for example, many of the natives know how to dig wells six feet or more deep, in dry stream beds during the off season, and by the use of these wells they can cover much more territory in their hunting expeditions than they could without them. The simple well-digging which they perform requires no more complex tools than their ordinary collecting operations, and no group action. Aside from this Australian example, most people do not know how to dig wells. Historically this technique has been largely limited to the more complex civilizations of North Africa, Europe, and Asia; well-digging is usually a full-time profession. In Morocco, there are professional well diggers who come from the northern Sahara and who travel about the entire country digging wells for farmers and city-dwellers. Their profession is both skillful and dangerous, since these wells are often more than a hundred feet deep, and they have no competition. Without such deep wells, much of the arid lands of North Africa, Arabia, Persia, and Afghanistan, would be uninhabitable. In the United States, also, much of the landscape could not have been settled by white men if they had been ignorant of well-digging.

Petroleum, or mineral oil deposited in the earth, has been used for various purposes, including illumination, pitching or calking ships, paving roads, and setting bricks, for millennia.[12] Noah, according to the Bible, was commanded to "pitch the Ark within and without" (Genesis VI, 14). The Ancient Egyptians carried on a large import trade in bitumen, or petroleum pitch, which they obtained from the Red Sea; this pitch rose to the surface from the bottom and was collected. The Indians of Pennsylvania also used crude oil which rose to the surface through seepage, and the Ainu of Sakhalin Island also collected it.

Oil wells in many countries have long been made in the same way as wells for extracting water; in Burma and China deep oil wells were dug by hand before the invention of oil-drilling machinery. In China actual oil drilling has long been carried out by animal power; the technique was to drill with hollow bamboo or cypress tubes turned by an ox walking around and around a wheel; the same technique was used by the Chinese in vegetable oil grinding and in milling machinery. The first deep drilling, however, which provided oil that flowed upward through earth pressure, was done in Pennsylvania in 1859; the modern oil industry depends, and has always depended, on machine power and the use of tubular metal drills. As a by-product of this industry, modern Americans and Europeans have also de-

[12] Byron, Robert, "The Story of Oil I., The Rise and Meaning of the Oil Age," *The Geographical Magazine*, Vol. XII, No. 3, pp. 182-197, Jan. 1941.

veloped artesian well-drilling, and the extraction of illuminating gas, helium, and other gases.

SUMMARY

Before people can adjust themselves to their environments by manufacturing or processing materials for use, they must first obtain these materials. There are two principal ways of doing this: by *gathering* natural materials and by *producing* others by means of agriculture and animal husbandry. Techniques of gathering include (1) *Collecting,* (2) *Hunting,* (3) *Fishing,* and (4) *Mineral Extraction.*

Collecting is simply the technique of picking berries, digging roots, prying molluscs from rocks, etc.; it is simple hand work and requires no elaborate implements and no force other than the human hand, no action which involves particular skill, and no interaction. Collectors, however, often work in teams purely for the sake of companionship. Collecting is an important source of food and other materials among the most simply adapted peoples. It is usually done by women because it is one of the few techniques which they can practice away from camp or home which the presence of small children will not impede.

Hunting is usually a man's job. It requires skill, speed, endurance, and often long absences from home. Implements include weapons and traps. Weapons vary with the technical skill of the people who make them from a simple club or spear to a rifle; traps vary likewise, from nets and pits, which anyone can make, to such devices as box traps and spring traps in which a trigger is needed, and this involves considerable technical knowledge and skill. Hunting techniques strictly prescribe the amount and order of interaction. Some forms, such as stalking, require the hunter to work alone; others, such as surrounds and drives, make it necessary for large numbers of people to work together.

Fishing may be done by spear, bow and arrow, toggle hooks, poison, traps, or nets. Fish traps are simpler than animal traps, since they require no triggers or release mechanisms. Many fishing operations are performed individually; with sea fishing, however, there are also operations which require the timed interaction of many people, particularly in the use of nets. Sea fishing differs from inland fishing in that the supply of fish cannot easily be exhausted; hence at sea elaborate techniques which involve ships have been developed and this work is often carried on by full-time specialists.

The most simply adjusted peoples make relatively little use of minerals. Flint and stone for cutting tools, and clay and iron ore for pigments, are their chief requirements. Yet owing to the uneven spatial distribution of

these materials on the landscape they form the principal objects of trade. As people advance in technological complexity they use more and more minerals per capita. The techniques of mineral extraction vary in complexity from such operations as digging clay out of a bank or picking flint nodules off the ground to the workings of a modern coal mine or oil field.

CHAPTER 8

Husbandry—The Production of Animal and Vegetable Materials Through Domestication

I. INTRODUCTION

In this chapter we shall deal with the techniques which different peoples employ in different environments in order to produce food, fuel, and artifact material by the controlled breeding and care of cultivated plants and domestic animals. Agriculture and animal husbandry are both considered in a single chapter because these activities are closely related and often mutually dependent. For example, it is a common practice for food-producing people to grow cereals or root crops with which to feed their animals, and in return to fertilize their fields and gardens with the animals' dung; many of them also breed some of their animals for the specific purposes of furnishing traction for their agricultural machinery and for transporting their crops from field to granary or market.

Despite their close association, however, there is an essential difference between the techniques of agriculture and those of animal husbandry, which arises from the nature of animals as contrasted to that of plants. The farmer, once he has planted his crop, may leave it until it is ripe if it is a sown crop, or may have to weed and tend it a few times if it is a garden crop. In either case he can leave it untended for considerable periods, and he usually has time for other pursuits between growing seasons. The man who is herding animals, however, must watch them all of the time, day in and day out, at all seasons; often he will have to stay up all night to protect them or keep them from straying. If he keeps a few animals only and brings them in his house or barn for the night, he still has to see that they are fed and watered every day. Animals, in other words, require constant attention; plants as a rule do not. Furthermore, people interact with animals; they talk to them, caress them and express affection for them, or punish and curse them. In many cases, interaction with animals serves as a substitute for human interaction. When we study the adjustments of pastoralists to their environments we must keep this fact in mind.

II. THE MATERIALS OF HUSBANDRY

A. The Materials of Agriculture

The species of the vegetable world which human beings have domesticated and, in most cases, altered by selective breeding, are extremely numerous, totaling several thousand. They are, however, largely confined to one family, that of the angiosperms or broadleaf plants, the only exceptions being a few edible fungi, such as mushrooms, and conifers grown for lumber. The broadleaves are divided into *perennials,* including woody plants or trees; and *annuals,* including the grains, legumes, and most of the garden vegetables. While both woody and annual species are cultivated, it is the annuals which form the basis of most types of agriculture, and which provide the human species with the bulk of its vegetable food.[1]

In the utilization of plants for food and for manufacturing purposes, all portions of plants may be used. Most plants, however, are selectively grown for the special utilization of one part only, and that part is superior in size or quantity or in some other way to the corresponding part of the natural species. For this reason we shall classify them in terms of these parts. The classification includes (1) seeds, (2) pod and pod-fibers, (3) fruits, (4) nuts, (5) roots and tubers, (6) leaves, (7) stems, (8) piths, (9) saps, and (10) barks.

1. Seeds. The most useful and widely grown of all plants are those annuals which furnish edible seeds; these include the *cereals,* the *legumes,* and the *oil-seed plants.* From the first chiefly starches are derived, from the second proteins, and from the third vegetable fats.

The cereals include the grasses such as wheat, barley, rye, oats, millet, sorghum and rice, and also the numerous varieties of maize. Among the legumes are all of the world's beans, peas, chick-peas, lentils, vetches, and peanuts. Other seed-plants comparable in use to the legumes are quinoa (Chenopodium quinoa), a domestic species of goosefoot cultivated in the Andes, and buckwheat, native to Eastern Asia. The oil plants, which are less numerous, include mostly sesame and flax, and some of the legumes, such as the peanut.

The advantages which may be derived from the cultivation of seed annuals are great; they may be sown broadcast, except for maize and wet rice; and they may be reaped in bulk, with sickles or scythes, and threshed with flails or by animals. They may be easily packaged, owing to the small size of the units, and easily stored. If they are kept dry, they will last for years.

[1] See Ames, Oakes, *Economic Annuals and Human Cultures,* Cambridge, Mass., 1939.

Furthermore, the yield per acre is, under ordinary conditions, great. A balanced diet which includes cereals, legumes, and oil plants provides the essential needs of the organism in carbohydrates and proteins, and, if they are properly processed, most of the necessary vitamins as well. The stems of some of these seed annuals may also be used as fodder, and of others as bedding for domestic animals. One legume, the soy bean, has become a basic material in the manufacture of plastics. Beside the annual plants, there are some perennials that furnish useful seeds as well; these include the coffee and cacao trees, both of which are cultivated.

2. Seed Pods and Pod Fibers. Seed pods are relatively little used for food, except for the haricot types of bean and carob seed pods. However, fibers which protect the seeds in a number of pod plants are used extensively in manufacturing; these include cotton, tree cotton, and kapok.

3. Fruits. Fruits may be divided into annual and perennial varieties; annual fruits include the gourds, melons, squashes, and tomatoes; and perennial fruits, which grow on bushes and trees. The plantains and bananas, which take three years to mature and then die, form a tropical extension of the annual category. Tree fruits include the date, the olive, the fig, the rose family (apples, pears, haws, quinces), the almond family (peaches, plums, apricots), pomegranates, the citrus family (oranges, lemons, grapefruit, tangerines, etc.), the vine, the pandanus, the breadfruit, and numerous tropical species such as the avocado, the mango, the jackfruit, persimmons, sour and sweet sop, etc.

Fruits are seldom cultivated as single, or even principal, crops; most people who raise them use them to supplement other forms of vegetable diet. Fruits occupy, in many cases, lands too steep for seed or root crops, or lands which would be too moist or otherwise unsuitable for the growth of staples. Another advantage is that some fruits, including the date, the olive, the grape, the fig, and the various members of the almond family, can be easily preserved, by drying (date, fig, almond family), by pressing into oil (olive), or by conversion to wine (grape). In regions where such methods of preservation are practiced, fruits often become the principal cash crop.

4. Nuts. We have already mentioned the almond family, one member of which, the almond itself, must be classed with the nuts. Walnuts and chestnuts are also cultivated for food in some regions; the African kola nut is widely traded both in Africa and outside. Cocoanuts, too, fall into this category; they furnish food and drink on many Pacific islands where human life would otherwise be without subsistence. They also are grown extensively for copra, the rotted meat from which cocoanut oil is made, and which is widely used in manufacturing. Other tropical nuts are used for the same pur-

pose, including the ivory-nut. Cocoanut trees are among the most useful plants grown, for aside from the nut itself they provide sap, which is made into a beverage, wood for building houses and ships, and fronds for roofing.

5. Roots and Tubers. Roots are second only to seeds in importance as human food. They will grow well in damp places in contrast to the seeds, which grow mostly in arid and sub-arid lands. Hence the two furnish the staple food crops in different types of environment, although there is, of course, a considerable overlapping especially in the case of maize and rice, both of which will grow in wet and semi-dry lands alike. Among the principal root crops are the turnips, the beets, the cassava, or manioc, in both sweet and poisonous varieties; yams, sweet potatoes, white potatoes, and taro. All of these provide an abundance of starch in regions favorable to their growth. With the exception of the white potato, which was developed in the cool highlands of Peru, they are all tropical. Temperate root crops, used less for human food than for fodder or processing, are turnips and beets; turnips are fed to animals, and beets are made into sugar.

Roots cannot be stored as successfully as grains, and in most cases will not last more than a year. The techniques employed in planting, weeding, and harvesting them are relatively laborious. Furthermore, roots provide starches and sugars only; there are no protein or oil-producing roots. As a class of foodstuffs, therefore, they are inferior to seeds. Their chief virtue is that they will often grow where seed crops are unsuccessful.

6. Leaves. Leaf crops form a relatively small part of the human diet in any region, except for the cabbages, which are leafy members of the turnip family. Lettuce, spinach, watercress, and similar greens are eaten mostly as relishes, and many peoples never eat them. Much more important, however, is the use of leaves such as flax, hemp, and sisal for fibers to be used in cordage and textiles. Other leaves, such as tobacco, tea, and cocoa, furnish drugs, and their cultivation in special areas becomes a cash-crop business.

7. Stems. Aside from a few plants such as rhubarb and asparagus, stems are not widely eaten. With these exceptions and that of the lumber and pulp trees planted by modern foresters, few plants are grown primarily for their stems, although the stems of many are used secondarily. Some woods, such as the olive, are highly prized in carpentry; the olive being especially sought for plows. Few people, however, would cut down an olive tree for its wood if it were vigorous and bearing well. Cocoanut trees also furnish most of the wood used on the smaller islands of the Pacific, while the same is true of date palms on many African and Asiatic oases. Stems of some of the larger annual plants, such as maize and sorghum, are often used in building, while

the straw of small-grain cereals furnishes, in many regions, material for thatching, and tempering for brick-making.

8. Piths. Relatively few plants are grown principally for their pith; in fact, there is but one important species, the sago, which is not only collected wild but also cultivated in New Guinea and other parts of Melanesia. Comparable fan-palm trees similarly used in South America are not cultivated.

9. Saps. Relatively few plants are cultivated for their saps. The most important is the sugar cane, grown in most low-latitude regions where water is abundant. Others include the sugar maple, planted in groves in North America by whites and tapped as a wild tree by the Indians, the century plant, or maguey, in Mexico, which is found both in wild and cultivated states, and which provides the material for a fermented drink, pulque, and poppies, the gum, or congealed sap, of which is crude opium.

10. Barks. Aside from the spices, no trees are cultivated for their barks for purposes of providing food. There are, however, trees which are grown expressly for their bark, which is pounded into bark-cloth. Chief of these is the paper mulberry. Mulberry trees are grown in some regions, however, not for their bark but for their leaves, which are fed to silkworms and thus converted into silk, just as pulpwood is elsewhere converted by mechanical means into rayon.

The Results of Selection. After a crop has been harvested, the farmer must set aside some of it to be used for the next year's seed. Sometimes he selects this at random, but more frequently he will choose it on some particular basis of discrimination. In the case of rice or millet, he may set aside the seed from a plot which bore especially well, or he may prize the plants which ripened earliest and use their seed the next season so as to shorten the period of growth and provide his family with grain as early as possible during the hungriest time of year. The maize farmer may select his ears for seed on the basis of color, which to him has a symbolic meaning, and also on the basis of the size of the ear and the regularity of the kernels.

As a result of this selective process, farmers have profoundly altered many of the species of plants grown for food; a good example is the turnip, which has been altered by selection into such diverse vegetables as cabbage, Brussels sprouts, broccoli, and cauliflower. According to the botanists, the most changed of all is maize, which has acquired a husk to keep off birds during the ripening season, but which at the same time prevents the plant from reproducing without human aid.

This selective process has not only greatly enlarged the variety of plants used for food, but it has made them much more productive than their wild

prototypes. In Melanesia, people grow cultivated yams six feet long and a foot or more thick; the miserable root which the Australian digs wild from the ground is no more voluminous than a cigar. The wild apple produces a moderate crop of small fruits, little larger than golf balls; domestic apple trees, when properly pruned and sprayed, need to have their limbs braced with poles to keep them from breaking under the weight of their fruit. There is thus a quantitative aspect to selection, which in itself renders agriculture superior to the collection of wild vegetable products, wholly aside from the fact that the farmer can grow many more plants than he or his family could ordinarily collect.

B. The Materials of Animal Husbandry

The number of animal species which have been domesticated is far smaller than that of plants; in the entire world there are only 13 useful kinds of domestic mammals, 11 of birds, 2 of insects, and one of fish. Most of these domestic animals have been selectively bred, and almost all of them are visibly different, as a result of domestication, from their wild prototypes. Like many domestic plants, many of those which have been most highly selected for special qualities would probably become extinct if set free to fend for themselves.

The animal which has been most highly altered in bodily form by selection is the dog, the breeds of which differ much more widely than do the human races. Probably second to the dog in the degree of alteration is the sheep, whose woolly undercoat has been made to grow into a fleece, while the coarse cover-hairs have been completely lost. As in the case of plants, these selective alterations have made the animals much more useful to men than their wild prototypes can have been.

Whereas plants are altered by selection only, animals are altered both by selection and by conditioning. Most domestic animals require some sort of training, if they are to be useful, and if they are to be kept from running away. This training varies greatly with the animal in question; a dog is trained to follow game by scent, to point, to retrieve, and to dig burrowing animals out of their holes; a horse is trained to respond to the rein in driving, to the bridle in riding; an elephant is trained to carry people on his back, to kneel when directed, to pile wood, and perform other tasks. In one species, the falcon, it is necessary that this training be given the young animal, not by men but by its own wild parents. The elephant also must be taken in the wild state, not for this reason but because it takes a long while to breed in captivity, and it is easier to capture new ones than to wait for

them to reproduce. Hence the falcon and the elephant have escaped the selective process. Many animal breeders also find it easier to handle and train male animals if they castrate them; thus oxen and draft horses, as well as sledge reindeer, are often geldings.

The uses to which domestic animals are put may be divided into two classes, *lethal* and *non-lethal,* depending on whether or not the animal need be killed to be useful. The lethal uses include the production of meat, skins, bones, horns, teeth, etc.; the non-lethal wool, milk, eggs, feathers, honey, dung for fuel and fertilizers, and services such as hunting and transportation. The fact that domestic animals can be used without killing them makes animal husbandry more productive than hunting in more than one sense.

As in the case of domestic plants, we shall discuss the principal domesticated animal species briefly in terms of use.

1. Lethal Uses. So great is the advantage of the non-lethal uses of domestic animals that few species are bred specifically for meat, although most of them are eventually eaten. Pastoralists who depend upon their animals for milk, for example, will not kill them until they are ready to die, if their other sources of food are sufficient. There are several species of animals, however, including the ox, the sheep, and the reindeer, which have been selectively differentiated by animal breeders into meat strains and milk or wool strains, and which are quite different from each other. Even the dog, in some countries, has been specifically bred for the table, as in Mexico, where the Aztecs produced the hairless dog as a table delicacy because in aboriginal Mexico there was a large population with an abundance of vegetable food and little meat.

There is one animal, however, which is bred for meat and meat alone; that is the pig. The pig grows rapidly, matures quickly, produces many young in one litter, will eat almost anything, and can be fattened rapidly to a great size. It thus furnishes an abundance of animal carbohydrates, and is in this sense comparable to sea-mammals and to the bear. In Mediterranean climates, it can be grazed out of doors in scrub forests, where it becomes fat on acorns and roots, and does not require any of the agricultural products which the people eat. In urban regions in any climate, it can be fed on garbage, and is thus equally economical to keep. Among commercial agriculturalists, who produce a great surplus of grains, it can be easily fattened as a cash crop. But in tropical forests, it must be given food that people eat, such as taro, yams, and cocoanuts; therefore few pigs are kept there and their flesh is a luxury. Despite this fact, the pig is usually the only animal kept in tropical forests, since it is the only one suited to the climate. Hence

in Melanesia and Polynesia, and parts of Negro Africa, the principal domestic animal is the pig, and it is ordinarily eaten only on important occasions.

2. Non-Lethal Uses, Milk. Many species of mammals have been milked or are milked in one environment or another. The cow, the camel, the reindeer, the goat and the sheep are bred specifically for this purpose. In Central Asia, pastoralists milk mares also, and in parts of Western Asia asses are milked, but both these animals are bred primarily for transportation purposes. Of all the animals bred for milking, only two have been greatly altered in their milk-giving capacities from their wild state; these are the cow and the goat, which furnish many times the amount of milk that their wild prototypes can give, and for all instead of a part of the year.

3. Non-Lethal Uses, Fibers. The same generalization is true in the case of fibers; people use the hair of many animals for cordage or textiles, but there is only one, the sheep, which has been greatly altered over a long period of time by its use. A good sheep produces some eight or more pounds of wool, many times the weight of the coat of a wild sheep. Other animals selected to a lesser extent for their wool or hair, are the camel, the yak, certain varieties of goat, the llama, and the alpaca. The alpaca is raised for the sake of its wool, but its special diet limits it to small areas of the Andes, and it cannot be used for transportation like its relative, the llama.

4. Non-Lethal Uses, Eggs. The domestic hen, as developed in the commercial civilizations of Europe and America, has been generally selected on the basis of its ability to lay eggs. Its degree of alteration from the wild form in this respect is as great as the alteration of the milk-cow or the sheep. Other birds kept for eggs include the duck and the goose, but neither these, nor the turkey, nor the guinea hen have developed a laying capacity comparable to that of the hen.

5. Non-Lethal Uses, Feathers. A number of birds have been raised especially for their feathers, and in some cases they have been selected on this basis. In aboriginal America, the Indians kept turkeys largely for this purpose, since they wanted the feathers for ceremonial use; in parts of South America, people kept parrots for this purpose also. In Europe, before the days of firearms, people kept geese partly for their excellent feathers, which fletchers used in feathering arrows.

6. Non-Lethal Uses, Honey. One of the most widespread of domestic animals is the bee, of which the two principal varieties are the common honey bee, with which we are familiar, and the stingless bee of the tropics. Many people who have few if any other domestic animals than the dog are bee-keepers; even the Vedda of Ceylon, simple hunters living in caves, keep bees and trade honey to outsiders as one of their principal cash crops.

7. Indirect Uses: Silk. The only domestic insect besides the bee is the silkworm, which wraps itself, in the larval state, in its own silk. There are many species of silkworms in different parts of the world, but only the Far Eastern variety has been domesticated.

8. Animal Services: Hunting, Herding, etc. So far we have considered ways in which the animal is of use to the owner in a direct sense, and in the sense that it provides the owner with *materials* which it produces or gathers. Some animals, however, are most useful in providing *services,* the most important of which are *hunting* and *transportation.*

The one animal which has been actually altered through selective breeding for hunting is the dog. Most of the existing breeds were developed for some particular phase of hunting, such as tracking (bloodhounds and the hound tribe in general), hunting by sight (sloughis, greyhounds, etc.), retrieving from dense brush or from water (setters, spaniels, etc.), digging burrowing animals out of their holes (terriers, dachshunde, etc.). Some have also been developed for sport, such as the bulldog and the bull terrier, and others for size and ferocity which make them good watchdogs. Still others have been selectively bred as aids in herding domestic animals, such as cow-dogs and sheep-dogs, including collies and shepherds.

There are a few other animals which have been domesticated for hunting, but these have not been visibly altered; they include the cheetah of India, a large cat with long legs and non-retractible claws, which can run down most kinds of game; the ocelot of Central America; and the domestic cat, which owes its widespread popularity to its excellence as a mouser and ratter. There are two other domestic hunting mammals, both members of the weasel family, the mongoose of India, a snake killer, and the ferret, a native of North Africa, a rabbit killer.

The hunting birds, the falcon and the comorant, which the Chinese use as an aid in fishing, have likewise not been selectively changed.

9. Animal Services: Transportation. Except for the pig, most large domestic mammals are used for transportation in one way or another. The principal species used for this purpose, however, are the horse, the ass, the ox, the buffalo, the yak, the reindeer, the camel, the llama, the elephant, and the dog.

In favorable environments, the horse is by far the most desirable animal for human transportation. Of all the animals large enough to carry a man, it is the most responsive and tractable; in short spurts, it is also the speediest; and furthermore, it is the only animal from whose back men ordinarily fight in hand to hand combat.

III. THE TECHNIQUES OF HUSBANDRY

A. Agriculture

In the last chapter we considered the techniques of collecting, hunting, and fishing, in terms of four factors, the implements and forces used, and the actions and human relations practiced. In this chapter we shall follow the same system, but for convenience we shall put these four factors in a different order, using *forces* as our initial criterion.

There are three main sources of energy which agriculturalists so use: (1) *Human Muscular Energy,* (2) the *Energy of Domestic Animals,* and (3) the *Energy of Natural Forces* as applied through machinery. People who use the energy of domestic animals in their agriculture also use human muscular energy; those who use natural forces do so likewise. Those who use the energy of natural forces, however, do not necessarily use animal energy as well.

1. Human Energy Alone. People who use human energy alone in agriculture and in the transportation of agricultural implements and materials are usually, by virtue of this limitation alone, restricted to subsistence tillage. Their work takes a maximum of *time* per man per unit of food produced, hence there is little surplus, and this can be moved only by human porterage or in small, hand-propelled boats.

Implements. The simplest, most basic implement which hand cultivators use is the *digging stick,* a direct carry-over from the tool-kit of the collectors. With it many tropical forest cultivators make holes in the soft earth, after the foliage overhead has been removed, for their planting. In temperate and mountainous regions, however, it is still used in several areas, notably in Peru and, until recently, in western Ireland.

The *hoe,* a technically more advanced implement than the digging stick, is used as the chief agricultural implement by most peoples in Africa, Polynesia, and some parts of the Americas. The hoe consists, as a rule, of two parts, the handle and the blade. The latter may be made of flint, of shell, or the shoulder-blade of some large animal such as a bison; or it may be made of metal, as is usual in Africa.

Another implement of paramount importance to many farmers is the *ax* or *adze,* a cutting tool needed to fell the trees, or at least to remove their branches, in forest regions both in the tropics and in mid-latitude regions. For harvesting grains, legumes, etc., some people use simple *knives* (Bemba, Borneans, etc.), others have special *sickles,* or curved knives with the inside of the blade sharpened. Archaeologically, sickles made of long blades of flint, or of a series of small blades set in wood or clay, have been found; all con-

temporary sickles are of metal. The *scythe,* a long blade swung on a handle and used in mowing hay, is a northern European invention useful for farmers who stall-feed animals in the winter, but it has not been widely adopted outside the areas of North European colonization in temperate and boreal climates.

Our list of hand implements must include *flails,* or jointed sticks, used in threshing, and *rakes.* These two are of Old World origin and relatively restricted use, since they are of value only where small-grained cereals are used, and where grass is mowed for hay. All people who practice hand agriculture have some containers, usually baskets, to carry their produce home, and some kind of storehouse or granary in which to keep it. The character of these storehouses depends largely on the environment. In dry regions, as in the American Grasslands and in North Africa, the farmers dig bottle-shaped holes in the ground and line them with clay or plaster; they fill these with grain and cover the holes with stones. In most of Negro Africa, the granary is a wattle-and-daub building with a grass roof, and is often set on piles. In Southeastern Asia and Indonesia also, it is a building on piles, where rodents cannot get at the grain.

Actions and Interaction. The implements used in hand agriculture are, as we have seen, of a simple character; they are, in fact, simpler mechanically than some of the devices used in hunting. The actions performed in agriculture may also be simple; many of them require less skill than is the case with hunting. In hunting and in gathering, we saw that the element of timing was of considerable importance; for example, a man shooting a bow must know exactly when to release the arrow, and a group of beaters in a surround must begin at once and advance at a constant rate. Furthermore, there is a seasonal aspect to hunting and to collecting; in many environments, the animals migrate at definite times of year, and the wild vegetables are ripe, or ready to be collected, at certain seasons only. In agriculture, this element of timing is also important; for example, in a monsoon forest region, it is necessary to know in advance just when the rains will begin to fall, as the ground must be prepared and the seed sown beforehand. In a temperate region, as in the Mediterranean, where many different kinds of plants are grown, each has its seasonal cycle, and the calendar of agricultural events has been arranged so as to give the maximum variety and maximum yield each year.

The actions of the hunter, among the Andamanese and the Australians, for example, revolve around a *daily* cycle, getting up, going out hunting, coming back in the afternoon, eating, talking, dancing, and sleeping; the hunter's wife, who is a collector, will go out after vegetables, get firewood

and water, return to camp early in the afternoon, prepare the meal, etc. These hunters also follow a *seasonal* or annual cycle to a varying degree, depending on the amount of variation in the seasons in the environment in which they live.

The same is also true to an even greater extent in the case of the farmer. His timing need be less accurate than that of the hunter shooting a deer or harpooning a seal, but it must follow the daily and seasonal rounds faithfully if he is to be successful. Most hunters get their food from day to day; the farmer often has to raise his year's supply in a single season, and in times of emergency, such as getting in the hay before the burst of an oncoming thunderstorm, rapid work and close coordination are necessary. Those of us who have lived on farms know about getting up at five to feed and milk the cows, to clean the stable, feed the hens, bring in firewood, pump water, etc., throughout the day; we know about the seasons of plowing and of harrowing, of putting in the early peas and potatoes, of haying, and of planting the winter wheat. In the case of the farmer, it is usually the wife who has the narrower *daily* round, of milking, cooking, house-cleaning, etc., while the men are more concerned with the *seasonal* round. This is true among farmers who use hand power only, as well as among our own farmers.

Clearing the Land. Let us examine some of the specific actions which hand-farmers make in the course of their daily and annual labors. The first is clearing the land, making new land ready for agriculture. In forested regions, this means first of all removing the trees so that the plants will get some light and will not be choked by underbrush and weeds. In Borneo, where the native farmers have to remove large trees which furnish a dense leafy roof overhead which allows little undergrowth, early in the dry season the men get together and chop down the trees along the stream-banks with their iron axes; they cut high on the trunks above the arched roots, to save labor. They cut these trees on the bank nearly through, and when the especially large key-trees higher on the slope are felled, the large trees fall and carry the others with them. Usually a gang of men does this together; one man can manage it alone and sometimes does, but it is more agreeable for the men concerned to work in a gang; the time seems to go faster, and the area cleared in a day is comparatively large.

In Africa we have a record of the clearing activities performed by the Bemba in Northern Rhodesia. Here a number of men will clear all the fields belonging to them, in turn. The men climb the trees and chop off the limbs with small axes, leaving the trunks standing. The work is strenuous, exciting, and dangerous. It offers an opportunity for rivalry; the men shout as they hack at the limbs, pretending that they are dismembering enemies. As

each limb falls, they shout special cries. The young men in particular take pride in climbing the highest trees and taking the most dangerous chances; their conversation when they are off the ground is largely concerned with tree-cutting, even in non-cutting seasons. Tree-cutting gives them an excellent chance to adjust their personalities to each other, to acquire prestige, and establish leadership; it serves the same purpose that warfare or wealth does among other peoples.

In forested lands where this tree clearing is practiced, the next step is to burn the trees or branches after they have dried out. The men who have cut the trees then must trim the branches and flatten them, so that they can be piled to burn evenly and deposit ash over the whole field. Among the Bemba, the men lay the branches in rows, butts all in one direction, so that when the women heap them in piles later, each wife will know which branches were cut by her own husband, and will be responsible for them. The women lay the wood in piles, so arranged that all the ground is covered. The burning must take place all at one time, after all the fields have been spread, in order to insure an even distribution of the ashes. For this reason, the paramount chief or king sets the day, which must be before the beginning of the seasonal rains, and he makes new fire with appropriate ceremonies and sets his fields, which have been cut and spread by his retainers, on fire. This is the signal for all of his subjects to follow suit; he lights his fire at night, and the glow can be seen for miles; messengers run from the king to the local chiefs, who give the word in their villages, and soon the whole land is ablaze.

The act of burning the branches "destroys the weeds and produces a fine, friable soil as a seed-bed. It also increases the phosphates and potash in the soil, and turns it slightly alkaline from being slightly acid, and makes it more highly saturated with calcium." [2] In tropical forests, therefore, this *slash-and-burn* technique, as it is often called, renders the soil very fertile for a short while, and very easy to work. This technique is feasible for people who have metal axes; for those with stone axes it requires more labor. Stone ax users, as in Melanesia and in South and Central America, often fell their trees by a combination of chopping and burning; the usual technique is to ring the bark and kill the tree, let it dry, and then burn through the trunk, or else fell it by a repeated sequence of charring and chopping.

Selecting the Land. Land clearing, which is a major activity in forested regions, is, of course, much less important in grasslands and in relatively dry country. The *selection* of land for cultivation is much more of a problem.

[2] Richards, Audrey, *Land, Labour, and Diet in Northern Rhodesia,* Oxford Univ. Press, 1939, p. 289.

Let us take, for example, the choice of land made by the Hopi.[3] In the Hopi country of northern Arizona, the rainfall per unit of land area is not sufficient for agriculture. However, much of this water is drained off in a complicated system of natural gullies and arroyos, and thus there are small areas in which the soil remains saturated with water drawn from the land surface as a whole. These small areas, about one-twentieth the size of the untillable drainage areas, are found at the mouths of arroyos, on flood-plains and on the flood-terraces of larger streams, and in *trincheras,* or artificial terraces made by building a low wall of stones across the bed of a stream, so that the silt will be deposited behind the wall during the floods. The Hopi farmer is very active in flood time, digging channels to spread the water so that it will reach all of his fields, and even individual plants in it; he also constructs wherever necessary low walls to spread the flood water and prevent it from cutting a gully through his garden. Furthermore, the fences around the cultivated land hold back the silt, and result in the formation of shallow terraces.

Another type of land which the Hopi selects for farming is sand dunes on hill slopes, with soil underneath the sand which will hold the water seepage. This type of land is especially good for raising beans, which have long roots. The farmer must clear much land outside the field itself, to permit water seepage; he must also protect each plant from the wind by stones, or a tin can; at the foot of the field he builds a low wall of stones to hold up a wind-screen of brush. The preparation of this land, therefore, is a relatively laborious process.

Each year before planting time, the Hopi farmers get their land ready for use, and also prepare new land if some of the old fields are exhausted or denuded of top-soil. In the case of new land, they clear all the brush, as well as the weeds, and burn them.[4] The implements used in clearing are an ordinary digging stick for levering up bushes, and a paddle-shaped pusher-stick, for turning over the ground, or a hoe. As in the case of the slash-and-burn farmers in Africa, Borneo, and elsewhere, the Hopi commonly get together large working parties in which each man does the same tasks as the others. With many men working at one time, a field can be cleared in short order. After they have cleared the land, they burn the bushes and weeds, but they do not make use of the ashes, which usually blow away.

There are few if any environments in which people utilizing hand labor

[3] Hack, John, "The Changing Environment of the Hopi Indians of Arizona," *Peabody Museum Papers,* Vol. 35, No. 1, 1942, Cambridge, Mass.

[4] Beaglehole, E., *Hopi Economic Life,* Yale University, Pub. in Anthropology, No 15, 1937.

alone can exploit all of the arable land in the landscape. One limiting factor is the relative laboriousness of the operations performed, so that little surplus can be accumulated; another is the wastage of the land, due to the failure to use fertilizer; a third is the necessity to make fields and gardens on spots which are properly drained and watered. One technique which many people practice to render a larger area suitable for cultivation is *irrigation.*

Irrigating the Land. Irrigation may, in some regions, actually precede agriculture. For example, in Owens Valley, California, the Paiutes dig trenches to water the valley slopes and foster the growth of wild plants, which they then collect; there is a chance, however, that this practice may have been introduced by Spaniards or Americans.[5] Irrigation involves digging trenches from springs or streams to lead the water along a lesser gradient than it would follow in the steeper stream bed; in this way, the irrigators can lead some of the water above the stream level and release it whenever they wish, sending it down the slopes, watering terraces and fields on the way. By so doing, they can water their fields during the dry season, and cease to depend wholly on rain. Thus they may not only enlarge the area which can be cultivated, but also extend the length of the growing season. In some places, this means that two or three crops, instead of one, can be grown each year.

The techniques of irrigation are largely hand techniques, but most of the people who irrigate have domestic animals. The reason for this is clear; people with animals can use the manure for fertilizer and thus use a given field over and over; people with animals can plow, thus making it possible to cultivate a relatively large area each year. There are a few examples of hand cultivators who irrigate, including the Hopi, previously mentioned, and the Pima and Papago of Southern Arizona. Among the Hopi, relatively few fields are irrigated, since there is little available water, but these fields are especially valuable since quantities of special crops are grown on them, such as melons and peaches, which are highly prized. The Hopi irrigation technique is to build a circular reservoir slightly below the source of water, and to irrigate from it through trenches; thus the farmer can obtain more water at one time than the spring itself produces.

The most extensive irrigation systems are those in the Mediterranean regions, in Southern Arabia, in Java, Luzon, Southeastern Asia, China, Japan, and Peru, in which whole mountains are contoured and built into step terraces. In all of these regions except Peru, animals are used in agricultural work, and in Peru they are used extensively for transport and to a lesser degree as a source of fertilizer. In a mountainous region like the Moroccan

[5] Steward, Julian, *Basin-Plateau Aboriginal Groups,* Washington, 1938, p. 53.

Rif, the valleys are high and deep, and the run-off slope of the streams is steep. For this reason the farmers living near the head of a valley can lead all of the water that they need for their terraces to a height of a hundred feet or more above the river level in the course of a few miles; irrigation ditches, therefore, vary in length from a few hundred yards to five miles or so. Hence the number of people who must cooperate in building and maintaining this ditch is the number of people living in this stretch of valley.

The farmers who use the irrigation water have a definite agreement that they shall work together to repair the ditch each year after the spring freshets, or whenever necessary; the amount of water which he uses annually determines the amount of work each farmer shall do, or have done. This water is measured by days or segments of days; one way is to use the water-clock, a pot with a small hole in the bottom. The farmer places the pot in the ditch where the stream is of a given depth; every time that the pot sinks he places a pebble on the bank, to represent one unit of measurement; when he has used his allotment, as measured by the pebbles, he closes his lead-off ditch and the next man begins irrigating his field. The farmer who has watered his top terrace lets the water seep into the soil, and then drain down to the next terrace; if he has fruit trees, he leads the water by little trenches to the roots of each tree.

This business of irrigation involves cooperative action, not because it is easier for a gang of men to work together, but because the irrigation water is shared by all the men, and hence all are equally responsible for the maintenance of the system. Like all cooperative activities, this work requires leadership; someone has to initiate the action. In this case it is the village clerk, the man who keeps a list of names of the men who owe work, and of the amount in each case, depending on the quantity of water used. Among the Hopi, the "crier chief" of the town gets the men out to work at clearing the spring once a year.

In large river valleys, such as those of the Nile, Tigris-Euphrates, and Hwang-Ho, the farmers are concerned with large-scale irrigation, since the slope of land is much gentler and the ditches are necessarily much longer. In the Nile Valley, a somewhat different situation occurs; here the river floods its banks once a year, depositing a red silt brought down from Ethiopia, and then subsides. The technique here is to build retaining walls along the banks to keep the flood water in after the river has subsided, and thus to saturate the soil, rather than to let it drain off rapidly. In the Great Plain of the Hwang-Ho, the river carries a heavy load of yellow soil, acquired farther upstream, and fills its bed with this silt; every so often it floods its banks, and cuts a new streambed. Here the problem is to prevent the river from

flooding the countryside, and to lead off what water is needed in irrigation ditches. Hence the Chinese have been obliged to build huge dykes as retaining walls. Both the flood-walls of Egypt and the dykes of the Hwang-Ho are engineering problems of great magnitude. Most of the labor used is hand labor, and the number of individuals who must cooperate in building them is vastly greater than in the case of the Riffian irrigation, or of any irrigation projects in the New World.

Preparing the Land. Let us now turn to a consideration of hand techniques employed in preparing the land for sowing; in the case of slash-and-burn agriculture, there may be no further preparation; in new fields, in densely forested country there may be no undergrowth between the stumps, and the action of the fire may have made the soil so friable that it does not need to be turned over or loosened. Whether the soil is to be prepared further or not depends on the type of crop to be raised; with small grains, such as rice or millet, which are sown broadcast, further work is not necessary; with root crops, however, it is a general practice to dig the soil into mounds.

Turning the soil with a digging stick or hoe is strenuous work, and the labor involved naturally limits the area which can be cultivated in this way. Cooperative digging is often practiced, not only because it is easier for most people to work in company, but also because there are some types of soil preparation which require it. For example, in Melanesia a work-gang of a dozen men or more will all plant their digging sticks in the ground in a line, and turn over a row of soil at once, and then move on to the next row. In Peru, likewise, this technique was pursued; there it is used particularly for turning large sods with men prying underneath from all sides. By this system a number of men can turn over the earth in their several fields in turn, and can work together on communal lands set aside to feed a chief or king, or to provide a common surplus.

Cultivating the Land. The activity of planting varies in accordance with the crops involved. Small grains are usually scattered broadcast, as in the case of the Bemba in East Africa. Here a man who is expert at this may be induced to sow for others, since it takes but a few hours for each field. He draws parallel lines across the field with a stick, about a yard apart, and walks down each strip holding a gourd or basket of millet seed in one hand, flipping the seed with an expert movement of the other hand, so that the strip will be evenly sown. Behind him walks his wife, scratching over the earth in the strip with a forked stick, so that the seed will be covered. Often the team consists of three persons, a man, a woman, and a child; the man and woman stand side by side, sowing together, and the child scratches the earth. The technique of planting dry rice is different; in Borneo, for exam-

ple, the planter pokes a shallow hole with his stick and drops in a few grains of rice; then he or his team-mate covers over the hole with a stick or with his or her foot.

With maize, sorghum, and cucurbits such as squash, pumpkins, and cucumbers, and with roots such as sweet potatoes, manioc, and taro, it is necessary to dig a larger hole and cover it more carefully. This again may be done by a single individual or by a team of two or three persons. A common practice of slash-and-burn farmers is to plant several kinds of seed in one field; thus the Bemba sow a little sorghum broadcast in their millet field before the main planting, and also plant a few manioc cuttings. The sorghum will be reaped separately from the millet, and the manioc, which takes two years to mature, will be dug later. In their mound-gardens, the Bemba plant such combinations as sorghum and sweet potatoes, and beans and manioc. A well-known practice of North American Indians was to plant maize, beans, and squash in a single hill.

Between sowing and harvesting, several other activities may be necessary in some regions; one is weeding, which cannot be done with small grains such as millet, wheat and rice, but which is advantageous in most climates with crops planted in hills or rows. Hand weeding is a laborious process, usually left to women among simple hand-power agriculturalists. Many of them do as little of it as possible, and in tropical forests, the growth of weeds is so great that it is one important reason for the abandonment of fields after a few seasons.

Another mid-season activity which is sometimes necessary is to provide protection against animal and bird pests; in Borneo, for example, the farmers station men and boys on day and night watches in the fields to scare away intruders; this works much better when a number of families get together and assign watchers to guard their combined fields one at a time. It is only possible, however, when the fields are adjoining. In other places, as in Africa, it is a common practice to build fences to keep out animals. Fence building is a laborious task, and man's work; a wooden fence will last only two or three years in the tropical forest.

Harvesting the Crops. The final event in the agricultural year of most farmers is the harvest; when the crop is grain, there is usually a definite time limit involved; the grains must be reaped exactly when they are ripe, no sooner and no later. Hence the harvest is a time when everyone, men, women and children, go out to their fields and cut the grain. They do this ordinarily by holding the heads of grain in one hand and cutting it with a knife or sickle in the other; they then drop the heads into a basket and go on to the next head or group of heads. This is a laborious process, and a rela-

tively slow one. However, it brings everyone out to the fields at once, and provides a maximum opportunity for interaction not only between members of a family but also between people working in adjoining fields. Since it also produces food ready for cooking, in great quantities, and is the culmination of the whole year's food-producing activities, naturally rates of interaction are high, and people adjust to each other at a higher level of intensity than during most other seasons.

The same is true of other crops besides grain which have definite harvest seasons, such as grapes in the Mediterranean region, olives and other fruits. In the case of root crops, particularly in the tropics, digging can take place at any time within a period of a month or more, and people usually take them out of the ground whenever they find time to do so.

People who conduct all of their agricultural activities by hand do not, in most cases, use fertilizer; in order to obtain this, farmers must have domestic animals to provide quantities of manure, or good transportation, so that they can bring fish and other fertilizers from a distance. For this reason, it is necessary for hand-labor agriculturalists, in most climates, to change their fields after a few years of cultivation. This is particularly true in tropical forests where the minerals needed for plant growth are washed deep into the soil beyond the reach of cultivated plant roots. In deserts, however, the soil is usually very fertile when it can be adequately watered, and lasts much longer. Where it is watered by seasonal flooding, the water usually brings with it minerals and other plant foods from the land drained, and hence flood-plain and arroyo-mouth fields can be used almost indefinitely. This is equally true in the great flood-plain of the Nile and in the small ones utilized by the Hopi. There is one special kind of soil—loess—which needs no fertilizing; it is the type of soil found in the great Yellow River valley of China, and it was on patches of loess that prehistoric farmers of Central and Northern Europe planted their fields.

Rotating the Crops. Crop rotation, or the sowing of different crops on a single field in alternate seasons, is frequently practiced by hand-labor farmers, not so much to enrich the soil and prevent its exhaustion as to provide them with several kinds of foods each year, since they can normally obtain only what they themselves produce. Thus the Bemba, for example, plant millet in new fields which have been cut over and burned; the next year they usually grow peanuts in it, and then another crop of millet. Often the field will yield no more after this, but if the soil is still productive, they may make it into mounds and grow a root crop. In the fields near the village, which are planted in mounds, they alternate combinations of roots, legumes, and maize and sorghum. Each year they cut and burn a new field to be sure to

have an adequate millet crop, along with these other vegetables. When the fields around the village are exhausted, which happens in about five years, they move.

In Borneo, the cycle is usually longer; they move on an average of once in twelve years. Here the village shift takes place when they have had to cut fields too far away to be reached conveniently by foot or canoe. In the old days, when they had to keep their fields close together for fear of head-hunting raids, they used up the near-by land more quickly, and had to move sooner. Linton has a theory [6] that the development of confederacies by the Maya and the Indians of the southeastern states was a consequence of this aspect of the slash-and-burn system; they found that if they could keep peace with their neighbors they could cut their fields further from the village than when they were in constant fear of attack; hence a number of villages would join in an alliance, so that they need have no fear of one another, and so they would not have to shift their villages at intervals. In the case of the Maya, the so-called "cities" were the market centers and thus, also, the religious centers of each federated neighborhood. From these centers, specialists would direct the agricultural program of the villagers and see that products were exchanged; they were responsible for the working of this system which permitted a greater agricultural efficiency.

2. The Energy of Domestic Animals. Among all peoples who use domestic animals in farming, a considerable amount of the work must still be done by hand methods; we shall concern ourselves here only with those techniques in which animals are used. There are some people, however, like the Quechua and Aymara peoples of the Peruvian and Bolivian highlands, who do not use animals directly in their techniques of cultivation, but who use the meat, skins, and wool of llamas, and who use their dung as fertilizer and fuel. By means of these animals they are able to transport goods long distances, and can in this way exchange products with peoples living in the lowlands and in other regions. The possession of these animals not only permits exchange, but it releases men from the activities of hunting, and permits them to spend more time on their farming. Most other agriculturists who have domestic animals capable of traction or transport or both, use them as a direct aid to their cultivation. The llama has never been used for plowing, harrowing, or the like, and is probably incapable of being used in this way. The larger Old World animals, such as the horse, ass, mule, ox, buffalo, and camel, are all suited for traction. Hence this use of domestic animals is (or was) confined to the Old World.

[6] Linton, Ralph, "Crops, Soils, and Culture in America," in *The Maya and Their Neighbors,* New York, 1940.

Implements. The implements ordinarily used with animals include, besides yokes and harness, the plow, the harrow, the smoothing-board, the sledge, and the cart. Other devices operated by animal power, such as the mowing machine, hay-rake, and manure spreader, are products of the machine age. The primitive plow, such as is used in many parts of the Old World today, is made of several pieces of wood: a pole, to go between the oxen; the plowshare, which actually turns the earth; a handle or handles; and various brace-pieces which hold these essential parts together.

Some plowmen still use all-wooden plows; however, many have adopted the metal plowshare—a tip, usually of iron, to fit over the end and prevent it from splintering and from rapid wear. The all-iron plow is an invention of the machine age and is only a century old. There is, however, a great range in primitive plows. Most of them will not make a furrow more than six or eight inches deep, which is sufficient in drylands or Mediterranean climates, but insufficient in temperate forests or grasslands. To overcome this difficulty the Saxons in England and on the North Sea coast of Germany devised the deep plow, drawn by eight oxen, which would turn over the soil to a depth of two feet or more. By means of this, they were able to cultivate the fens and marshes, which they also drained.

The harrow is not used by all agriculturists who have the plow; it is confined largely to Mediterranean and temperate climates. In its primitive form, it consists of a wooden frame in the underside of which are attached wooden pegs, metal spikes, or flakes of flint. The adjustable harrow, the spring-tooth harrow, and the disc harrow, familiar to American and Western European farmers, are products of the machine age, and hardly more than a century old. The harrow serves a number of purposes: to level ridges left by the plow, and thus prepare a smooth surface for sowing; to cover in seeds which have been sown broadcast or in furrows; to remove weeds, and to break the topsoil into small particles so as to hold moisture. In many regions where the simple plow is used, these operations are performed by hand labor.

The smoothing-board has a flat surface which is dragged over the land like a harrow to complete the action of leveling off the soil; in Northern Europe this was succeeded in the Middle Ages by a wooden roller. Sledges or stone-boats are commonly used for moving stones out of fields; they may also be used, as in the Basque country and elsewhere, for transporting seeds, crops, and even for carrying plows to and from the fields. Carts or wagons are used for this purpose in the regions where wheeled vehicles provide transportation; they also carry manure and other fertilizers to the fields.

Actions and Interactions. Plowing is usually a one-man operation, although sometimes plowmen employ boys to lead the animals. One seldom finds a number of men plowing together in a single field, since it is a relatively rapid operation, and one which permits a single man to prepare many times as much land in one day as he could with the digging stick or hoe. The same is true of harrowing and smoothing the soil. However, in regions where domestic animals are scarce, two men may combine forces in plowing, since each will furnish an ox or a cow to make up the team. This is a common practice in some of the Mediterranean countries.

Clearing the land for cultivation is also much easier with domestic animals than without them; an ox and a chain can be used to move stones; most of the stone walls of New England were built by ox-power—the ox will lean against the chain and hold a stone in place while the farmer adjusts it in the wall. Stump pulling and log rolling commonly required animal energy in the early days in America before the use of dynamite and tractors.

In irrigation, animals also have their uses; in Yemen, for example, camels walk down inclined paths to haul up huge leather water buckets from wells, and then walk back again; pairs of camels can be so well trained in this procedure that they will walk back and forth all day without supervision. In Spain, North Africa, and the Near East, donkeys are likewise trained to haul water by walking round and round a path, turning a cogwheel which raises water from a well in pots lashed to a wheel.

Before the days of the horse-drawn mower and rake, domestic animals had no immediate part to play in harvesting, but they have long been very important in many regions for threshing. The usual technique is to drive them around and around a threshing floor to trample out the grain from the chaff. This can only be done with hard, small grains such as wheat and barley, and with the more solid legumes, such as lentils and vetches.

None of these operations per se necessitate elaborate interaction. In all of them one man alone can guide the animals and manipulate the equipment. However, the care and breeding of the animals does require cooperation, as will be seen in the following section on the techniques of animal husbandry.

3. Machine Energy. It is the utilization of machine energy which permits the practice of agriculture on a fully commercial scale; here the energy used in transportation is as important as that in the actual operations of agriculture. The use of the sailing ship and the railroad, permitting the rapid exchange of products in bulk, made possible plantation life, with its concentrated specialization on single crops, and also permitted the development of the elaborate horse-drawn wheat-farming machinery used in the

American grasslands toward the close of the last century and the early twentieth. Before the industrial revolution, water power and wind power were utilized for special purposes in agriculture; for example, in Egypt, a large wheel, turning in the river, transferred its power to a smaller and slower wheel which lifted irrigation water. In the Netherlands and elsewhere, windmills pumped water out of fields situated below sea level.

These uses, however, were sporadic and localized; the great advance came with the invention of the tractor. One man with a tractor can plow many times as much land in a day as can a man with a horse or team of oxen; he can harrow it, plant it, and weed between the rows. He can mow his corn or other standing crops, dig his potatoes, thresh his grain, and chop up his ensillage all by machinery. He need not keep horses at all, and this releases the land formerly devoted to oats and hay to be used for cash crops; instead of manure, he uses chemical fertilizer. He can truck his produce to the market or city, and bring back his purchases. Agricultural machinery and machine transport permit the single farmer to till much more land than the horse or ox farmer, who in turn tills much more than the hand farmer. They also permit him to utilize lands otherwise unprofitable or difficult to cultivate. His interactions with others engaged in similar occupations may be reduced if he runs a one-man establishment; however, they may be greatly increased if he operates a large farm with many employees. In such a case, the farm personnel will include persons who perform different operations, including those who direct others. He can, furthermore, travel about over a wider area and discuss farming techniques with a large number of other persons. He can become a specialist, and can release a large proportion of the population to specialize in non-agricultural pursuits.

B. Animal Husbandry

The techniques of animal husbandry, like those of agriculture, may be classified in terms of the forces used, *human energy, animal energy,* and the *energy of natural forces* employed through the agency of *machines*. Most of the operations used in animal husbandry are actually hand operations; the difference between simple and more complex techniques depends largely on the element of transportation, which in turn depends on the type of force employed.

1. Human Energy Alone. People who depend on human energy alone in animal husbandry are relatively rare, since most of the animals bred in large numbers furnish some type of transportation, or at least people who breed animals unsuited for transport raise others as well which will serve this purpose. However, there are large areas, particularly in East Africa,

where people breed animals extensively and never pack or ride them or use them for traction. An essential difference between agriculture and animal husbandry is that animals move about of their own volition and with their own power; the herdsman, in most climates, must move about with them from one feeding ground to another.

Domestic animals, by their own living habits, impose a nomadic life on many peoples, while plants induce a sedentary existence. Another difference is that plants require but intermittent, or seasonal, attention; they must be planted, weeded, watered, and harvested at fixed times; animals, however, require constant attention, day and night, to see that they are fed and watered, are not attacked by predatory animals or men, and do not wander away. Domestic animals, furthermore, possess personality; their owners, or keepers, interact with them constantly. They talk to their animals, and often receive responses; this is particularly true of the dog and the horse.

Implements. The implements used in animal husbandry are few and relatively simple. Most people who keep domestic animals have some implements with which they catch them or lure them; these include the lasso, or noose on the end of a rope or cord, which is used by many peoples in both hemispheres, such as the Chukchi in Siberia, who catch reindeer in this way, and the horse-breeders of the Central Asiatic plains, as well as the American cowboy. The Mongols have a special kind of lasso which is a noose attached to the end of a pole. In South America, the Indians who took over the horse from the whites adapted the bolas, originally used in hunting, for catching horses and cattle. Reindeer-breeders use human urine, saved in bowls or frozen in lumps of snow, which the reindeer will come to lick.

Halters, bridles, hackamores, and other devices are used by almost all animal breeders to furnish a point of attachment by which they may secure the animals once they have caught them. Camel-breeders use ropes to tie the hind legs of their animals together so that they cannot rise and walk away; horse-breeders frequently use hobbles, or ropes hitching one hind to one front leg, for the same purpose. Corrals, fences, or other enclosures are also standard equipment, as are byres, barns, and other buildings erected for the express purpose of housing animals and protecting them against the elements or against thieves. The dog, a domestic animal, is also trained by many animal breeders to assist in herding.

Actions and Interactions. The act of catching animals for slaughter, milking, shearing, and the like, is in itself one of the principal activities of many animal breeders. Many animals, which have been on the move all day in a migration, or which have been used for transport, must be allowed to graze at night if they are to go on the next day; this grazing often leads

them far afield, and the herdsman often has to make long expeditions to round them up in the morning. The Lapps, for example, often have to go miles on skis to find their sled reindeer, and sometimes the caravan is held up for several days. The herdsmen who go after the animals must know the art of tracking, and must know animal habits well to estimate how far they have gone, and where; in this respect the herdsman must also be a hunter as well, at times; the Lapp must be prepared to fight off wolves from his herd, while the East African cowherd often encounters lions.

Tending animals, and permitting them to graze, means that the herdsman must adapt himself to animal habits and go where it is necessary for them to go. Very often the herdsman follows a completely solitary course; the sheep-herders of the American West, and the shepherds of Hungary, Rumania, and the Near East, often spend a month or more alone with their flocks. Tending animals, therefore, often limits interaction to the minimum. On the other hand, it is frequently a communal effort, involving many persons; domestic animals are usually gregarious, and a large flock may belong to many owners, who employ one or more herdsmen to care for it. In Persia, for example, a whole encampment of people will hire one shepherd to care for the sheep which belong to all of them.

Many people who keep domestic animals castrate the majority of the males, leaving only enough to serve the herd of females. In many herds of sheep, reindeer, and cattle, the ratio is as low as one male to thirty females. The reason for this is that the male animal, since he produces no milk, is relatively valueless. There are many techniques of castration. Most reindeer herders bite the seminal canals through with their teeth. This involves the interaction of several men; they usually hoist the animal up on a wooden frame while four men hold the legs; a fifth does the actual biting. Another technique, practiced widely in Africa, is to crush the testicles between wooden blocks; this also requires the concerted action of several men.

Most people who keep domestic animals in large numbers have developed some method of marking them indelibly. Reindeer owners notch the ears of their animals in individual patterns; many Indonesians do the same with pigs. An equally common practice is branding; Arabs brand their camels in the same way as the cowboys do their calves. In both operations, several men must cooperate; it takes at least one man to hold the animal while another man applies the iron.

Another common operation is milking. Here, however, one person can work alone. Many animals, unlike the common American dairy cow, cannot be milked without persuasion. In Central Asia, Africa, and elsewhere, it is a common practice to let the cow's newest calf suck for a few minutes, and

then tie it in front of the mother, who licks it while the milker is at work; this is done with camels as well as with cattle. In Arabia, if the camel-calf dies, the Arabs will skin it and stuff it, then they let another drink for a while, and give the stuffed calf to the mother to lick. Sometimes when the cow will not release the milk, the milker blows into her vagina; this practice goes back to the days of the Babylonians.

In East Africa, a number of pastoral peoples, loath to slaughter their cattle, open a vein now and then to draw out blood; they close the vein with a poultice of dung, and either cook the blood or drink it mixed with milk.

Shearing sheep is an operation which is done seasonally, and which involves the combined action of many people; the shepherds must round up their sheep and drive them to one place where they may remove the fleeces. The shepherds must know when to do this, in order to obtain the best fleeces, and also to keep the sheep from suffering from cold.

Many people who live in grasslands graze their animals entirely out-of-doors; in higher latitudes, however, it is necessary to put horses and cattle in stalls or barns for the winter, and feed them by hand. People who stall-feed their animals must be agriculturists as well, or must be in trade relations with agriculturists; they must have some way of obtaining hay and grain. In tropical forests where animal feed is also scarce, people who keep pigs must likewise provide the animals with food by means of agriculture; in much of Melanesia and Polynesia, the pigs are fed on the same vegetables that human beings eat, such as taro and coconuts, and consequently are highly valued, since a pig eats more than a man.

2. Animal Energy. The use of animal energy in animal husbandry depends, as we have previously stated, upon the use of animals for transportation. There is one exception, however, the use of the dog in herding. Dogs can be used to round up most species of domestic animals, and can even be trained to bring them home at feeding time. The use of the dog limits the number of men needed, and thus acts to reduce the amount of human interaction in many cases. Some peoples, however, do not like dogs for herding; the Reindeer Chukchi of Siberia, for example, do not use dogs because they say that the dogs scatter the reindeer, and often kill them.

With animal transport, the herdsman multiplies many times his efficiency in rounding up, protecting, and driving his animals. The Chukchi moves about with his herd in a reindeer-drawn sleigh; the Mongol and the cowboy, mounted on horseback, keep their herds of cattle on the proper grazing ground, drive them to water, and rope them from the saddle when they wish to catch them for branding, slaughtering, etc., or in order to separate the herds. One grazing animal which can be herded efficiently with-

out animal transport is the sheep; they are so slow moving that a man on foot can take care of them adequately. Men on horseback can, by virtue of their mobility, care for large herds of animals at once; for this reason, there is an incentive for a number of owners to graze their flocks together and take care of them cooperatively. With the horse, which is easily handled, the herdsmen can also fight off marauders, whether animal or human.

It is definitely advantageous for mounted herdsmen to pool their activities. They can take turns watching in the night; they can separate and go in different directions to find animals that have strayed and drive them home; they can also drive them better collectively than singly. For these reasons one usually finds herdsmen living in camps or communities in which there is a high frequency of interaction between the members; this may be a nomadic encampment or a ranch. The stimulus for interaction is greater in animal husbandry than in most kinds of agriculture, owing to the basic differences between animals and plants.

3. Machine Energy. The utilization of machine energy makes it possible to conduct the techniques of animal husbandry on a commercial scale. With railroad, truck, and steamship transportation, such products as wool, hides, milk, and live animals may be transported from the grazing lands or barns to the centers of consumption. Furthermore, the herdsman need no longer be isolated for long periods with his flocks; in Wyoming, for example, ranchers motor all over their domains in a few hours, finding out exactly where the animals are feeding, and relieving the men who are watching them. Machine energy is used to make barbed wire; irrigation of the type practiced in the West depends upon the machine use of water power. By means of barbed wire and irrigation, it is possible to pasture animals over a smaller area than was formerly the case, and thus to produce more animals per square mile.

People who keep sheep can now clip them with electric shearers. This practice also has reduced the number of men needed for this work. Dairymen milk their cows with electric milkers, with the same result. The amount of animal products, whether meat, hides, wool, or eggs, that a man can produce by his own energy in a given time has been greatly increased. Furthermore, the opportunity of interaction with others has been enhanced; the man who specializes in animal husbandry can go home at night and see other people; this is due not so much to the nature of his work, as to an increase in the efficiency of the techniques of transportation. The herdsman is no longer an isolated individual who interacts almost entirely with other herdsmen, but a specialist among other specialists in a complex world.

SUMMARY

Agriculture and animal husbandry involve the controlled breeding of plants and animals. These techniques are often interrelated because many people grow feed crops for their animals while they also use the animals for traction in agricultural work and as a source of fertilizer. These techniques differ essentially from those of gathering crops in three ways: (1) With husbandry the individual can produce his materials where he lives, or can live with his plants and animals, and can ordinarily increase the quantity of materials in a given area. (2) He can derive secondary products, such as wool, eggs, milk, etc., from animals without killing them, and thus use them over and over again. (3) He can breed the plants and animals selectively so as to get larger seeds, more abundant fruits, more eggs per hen, more wool per sheep, etc.

In view of these advantages, husbandmen can exploit most types of landscape more effectively than gatherers can. Furthermore, the domestication of animals gives them a source of power greater than that of human muscles, and one that can operate while the human muscles are resting, or even in the absence of the individual involved. These animals can be used for plowing, hauling, packing, riding, etc.—for transport as well as for agricultural work proper. The use of domestic animals has enormously speeded up agricultural techniques and the marketing of products. With them farmers and herdsmen may produce much more materials per hour of effort than most gatherers, and may thus amass surpluses. This will release other individuals from production so that they can be free to specialize in other techniques such as manufacturing and thus have time to work out ways of improving them.

The techniques of husbandry used in different parts of the world show a close adjustment to the several environments. For example, irrigation and flood control have been developed in low and mid-latitude river valleys and mountains, while in the boreal forests of the Old World, where agriculture is impossible and most domestic animals cannot be kept, people have developed reindeer breeding. These activities, such as irrigation and special kinds of herding, often provide the framework for the habitual interaction of individuals in a society and hence for its distinctive institutions.

CHAPTER 9

Transportation

INTRODUCTION

Throughout the last three chapters constant reference has been made to the subject of transportation. It has been repeatedly pointed out that the ability of people to move themselves and their possessions is a prime factor in the determination of the complexity of their adjustments to the environment. In this chapter we shall deal directly with the principal techniques of transportation by land, sea, and air. As before, we shall consider these techniques in terms of the tools or instruments, the sources of power, the actions, and the interactions involved. Our primary classification will be made, as before, in terms of the sources of power. On land, these are human muscle, animal muscle, and machine power; on sea, they are human muscle, wind, and machine power. In the air, with the exception of balloons and gliders, the power is confined to machines.

I. LAND TRANSPORTATION

Human beings, like other land mammals, transport themselves on land by the technique of walking, and they can also carry objects from one place to another. Walking and carrying without the aid of traction devices are the basic techniques of transportation which all people everywhere practice. In some parts of the world there are people who have no means of travel other than their own legs, but there are none without some form of container, as has been mentioned before. From the simple level of walking and hand porterage to modern transportation by railroad and automobile, one can trace a progressive developmental scheme; this can best be done in terms of the three sources of power: (1) human muscle, (2) animal muscle, and (3) the power of natural forces through the agency of machines.

A. Human Muscular Power

1. Devices. The devices used in transportation which depend on human musclar power alone include (a) *aids to walking,* and (b) *carrying devices.*

Aids to Walking. In some environments, walking is difficult without the aid of special devices. This is especially true of high latitude regions in which the ground is covered with snow during the winter, and in which the streams and lakes are frozen. People have invented four basic devices to overcome this difficulty, the snowshoe, the ski, the creeper, and the skate.

Most readers are probably familiar with snowshoes. They are usually made of a hoop of wood, with or without a tail at the rear, two or three crossbars, and a web of rawhide woven between holes in the frame. The snowshoer lashes one to each foot with thongs, usually leaving the heel free. All of the American Indians of the boreal forests of North America use snowshoes of this general type, and so do some of the Asiatic peoples, including the Chukchi and the Ainu. In Europe, particularly in Norway, the Carpathians, and Russia, snowshoes are also used, but much less frequently than in America, since in the European regions they have been largely supplanted by other devices. The European snowshoe is usually a round hoop with a few cross thongs and no bars; it is much inferior to the American Indian type.

The ski, which has long been used by most of the peoples of Siberia, is at present supplanting the snowshoe in Europe and North America. Most of the Siberian skis, which are built for work and not for sport, are short and broad, and many of them are lined on the under side with the legskin of some animal, to prevent backslipping. The Lapp ski, however, is long and slender, and it is from this model that European and American sporting skis were developed. All ski-users also use ski-poles, a pair of staffs with simple snowshoes, that is, round hoops with webs, at the ends.

The other two devices, skates and creepers, are designed for use not on snow but on ice. Skates, made with bone or metal runners, are not widely used; in fact, they are limited to China and Western Europe. They are usually employed for sport rather than for productive transportation. Aside from the metal variety which Europeans make, there are several other kinds of creepers known in the northern regions. One is the ivory creeper, which the Eskimo ties to the sole of his boot when he is going harpooning on the ice; another is the boot made by the Ostiaks of the Obi River country, who cut the bristly-haired pieces of skin from between the hoofs of their reindeer, and sew them together into a special sole which will not slip on the ice.

Carrying Devices. In moving goods, the simplest method is to pick up an object and carry it in your hand. More weight, however, can be carried comfortably if the load is transferred in some way to the shoulders, back, or head. As a rule, some container is used to enclose the load and facilitate its transportation. The simplest device, apparently, is the carrying net, slung

over the back, and used by the most primitive of food-gatherers, such as the Andamanese, Australians, and Californian Indians. African Negroes habitually carry loads on their heads; American Indians frequently use the basket and tump-line, in which a strap from the basket encircles the forehead, and the weight is carried partly by the back muscles and partly by those of the neck. North and Central Europeans, and most Northern and Eastern Asiatics seem to prefer the knapsack type, with shoulder straps. Shoulder yokes, of the Dutch milkmaid variety, are limited for the most part to Europe, and the high civilizations of Asia, such as China and Japan.

So far, we have been considering devices which only one person need use; there are, however, carrying devices which require two or more. These include the pole resting between the shoulders of two men, with a burden suspended from it, and the litter. The two-man shoulder-pole is widely used in Polynesia, Melanesia, Indonesia, China, Japan, and by the more advanced groups of Indians in Central American and the Andean region. In Melanesia, whole gangs of twenty or more men will carry a heavy object, such as a wooden slit drum, on a framework of poles.

The litter is a device by means of which either two or four men carry another person. Some litters are simply hammocks slung from poles and carried by two men; the ones used at Madeira as tourist attractions are of this type. Others are actually chairs fixed between two poles, and carried by either two men or four. It was on such a litter that the Sapa Inca, the Supreme Ruler of Peru, used to travel about his domain. An enclosed variety of this type of litter is the European sedan chair.

2. Operations (Actions and Interactions). All of the transportation devices mentioned above, aside from the two-man pole and the litter, require no interaction for their use. The individual walks forth on his snowshoes, or picks up his load and travels on with it all alone. Some of them, however, do require a certain amount of skill, and people who have been conditioned to one technique of transportation have difficulty in changing to another. Hence, the African or West Indian Negro carries burdens on his head; he will do this whether it is a jug of water, a bunch of bananas, or a sewing machine. The Indian of the American North Woods does the same with the tump-line. Thus there are ethnic habits of transportation, just as there are ethnic habits in most other techniques.

Among most peoples there is also a definite division of labor in the matter of transportation. The Ona of Tierra del Fuego relegate all transportation to their women; in a march between camp sites, the women will walk along the bottom of a valley, carrying a load of well over a hundred

pounds on their backs, while the men walk along the hill-slopes above them to shoot the guanaco which the tramping women start up. The reason for this division is not that the men disregard their women, but that they must have their hands free and their bodies unburdened for hunting, or for fighting if enemies should appear over the crest of the hills. As a rule, among most peoples women carry the burdens when the porterage is done for family purposes, and when the women have other work to do as well; men porters are usually professionals, as in China and Africa, who carry other peoples' burdens for hire.

The use of the litter, involving a special type of interaction between the passenger and the men who carry him, depends upon a number of special circumstances which are relatively uncommon. In the first place, there must be a considerable degree of specialization among the individuals concerned; the man who is being carried must be important to merit this favor. In the second place, there must be a lack of suitable domestic animals in the region concerned, or some special reason why the animals should not be used.

Such conditions were met in the more complex civilizations of the New World, as in Peru, Mexico, and among the Natchez of the Mississippi. One of the most striking uses of the litter was that of the Natchez at the time of the annual Green Corn ceremony. The subjects of the Great Sun, as the king was called, cleared a path from the royal pyramid, on which the king's palace rested, to the sacred corn field; on the morning of the ceremony the king stepped down to the foot of his pyramid and climbed onto the royal litter. Four men, who were holding it, then began to run at full speed. At the end of a few hundred yards, four other men, who had been stationed there, took the poles from them, like relay racers, then four others, and so on, until the king arrived at the ceremonial field, having traveled, in all likelihood, at an average speed of 10 miles an hour.

The litter and the sedan chair are the most advanced, the most complex technical means of transport devised for use by human muscular power alone before the adaptation of the wheel from the field of animal transport; this led to the wheelbarrow, the jinriksha, and the bicycle. In many parts of the world, native travel is being revolutionized by the bicycle; in Negro Africa it is a common sight to see dozens of natives riding about on them on the government-built roads, and the same is true in the Philippines, Java, and elsewhere.

B. Animal Power

1. Devices. The use of domestic animals for transportation takes two forms, *packing,* or *riding,* in which the burden rests directly on the animal's

back, and *traction,* in which the animal drags the burden behind him on some relatively frictionless device.

Packing. Almost all large domestic animals are used for packing by some people somewhere. There are a few exceptions, however; one is the pig, another the alpaca (see pp. 176-177). In Africa, the people who live on cattle in many cases neither ride nor pack them; this is true of the Nuer and other western Sudanese tribes, and of many East African people, such as the Masai.

People who pack animals usually need some kind of pack-saddle. There are two chief kinds, the wooden frame to which boxes and other containers can be lashed, and the stuffed-mattress type, which covers the animal's back and over which the packers can sling paniers. Some animals, however, can get along with paniers only; this is the case with the camel. In Arabia, drivers usually place a double-panier over the hump; there is a hole in the cross-matting between the pockets through which the hump protrudes. For this reason, the camel will not drop his load unless he is frightened and begins to run. Now that automobiles have been introduced into his country, this frequently happens.

Riding. The roster of animals which people ride is much smaller than that of those packed; it includes only the horse, the ass, the mule, the ox, the buffalo, the yak, the camel, the reindeer, and the elephant. Most people who ride these animals use some kind of a saddle and some device for guiding the animal. In the Old World, special riding saddles are made for the horse, mule, camel, and reindeer; people who ride donkeys usually have pack saddles. For riding horseback, it is much more comfortable to have stirrups, particularly when the horse trots or canters; nevertheless, many peoples who use horses do without them. The Greeks depicted on the Parthenon frieze are riding bareback—that was the habitual technique in the Mediterranean world of antiquity. Historically, the use of the chariot preceded horesback riding, which did not become general in Europe before the invention of the stirrup.

There are two animals which can be ridden, as a general practice, by two or more persons at a time; the camel and the elephant. In Arabia and North Africa, nomadic tribesmen build large wooden frames to fit over the camel's hump which will seat as many as five or six persons inside. They use these to carry women and children on the march. In India, it is customary to lash an even larger box-like structure, the howdah, onto the back of an elephant, and in it four or five persons can ride in comfort.

Traction. The techniques of packing and riding have considerable advantages; they permit the traveler or person transporting goods to move

over rough country without roads, and to cross deserts, mountains, and other barriers to which the particular animals in use are adapted. They have several disadvantages, however; since the burdens are carried directly on the animals' backs, they are wasteful of the strength expended. Devices used in traction require smoother country, in some cases prepared roads, but if they are efficient they require much less muscular effort per unit of goods transported. There are three classes of devices which people use for this purpose, (1) the *travois,* (2) the *sledge* and *sled,* and (3) the *wheeled vehicle.*

The *travois* is a frame made of two poles and a wooden hoop in which a net is woven. It was used by the Plains Indians, who loaded dogs with it at first, and later, when they acquired them, horses. The technique is to tie the poles together over the animal's back, so that the two ends drag on the ground behind the animal and to either side of it; they then lash the hoop-net to the poles behind the animal's rump. In this way the weight of the burden is supported partly by the animal and partly by the ground. The poles wear down as they are dragged, bumping along, but they offer only a moderate amount of friction. The travois is useful in steppes, where the ground is smooth, where there are few stones, and the grass is short; it would be of little or no use in most other types of environment.

Sledges are traction devices in which the bottom is flat, and the entire surface dragged over the ground; *sleds* have runners, and hence concentrate the friction in two narrow channels. Both sleds and sledges are used on dry ground and on snow. The sled used on dry ground is technically known as a summer sled.[1]

Summer sleds and dry-land sledges are confined to the Old World. The ancient Egyptians and Mesopotamians used both frequently, for hauling large blocks of stone to be used in building public edifices, and massive pieces of statuary. Sometimes they hauled these by means of animals, but more often large numbers of men drew them. In modern Europe and America, a similar device, the stone drag, is used for the same general purpose.

Summer sleds, equipped with runners, are still commonly used in a few places in the Old World, as, for example, in the Basque country, parts of Albania and Macedonia, Madeira, Sweden, and Siam. Except for special circumstances they are less efficient than the wheeled vehicle and have been largely replaced by it. In Madeira the roads are paved with small, hard, rounded beach pebbles, which can be collected in great quantities; sleds with iron runners, if greased once in a while, are more efficient than wheels on this surface. In Albania, the Basque country, and elsewhere, sleds are used

[1] Leser, Paul, "Landwirtschaftliche Sommerschlitten," *Ethnologica,* Leipzig, 1927, Bd. III, pp. 38-44.

with oxen on narrow paths in mountainous territory where wheels would be bogged down.

Compared to the summer sled, the winter sled or snow sled is a most efficient device. The inhabitants of the entire boreal forest zone of the world use some form of it. The toboggan of the Canadian forests is one of the simplest forms, with a flat surface, like a sledge; it is pulled either by human beings or by dogs. The *pulk* of the Lapps is also runnerless; it is shaped like a boat, with a flat board some eighteen inches wide for a keel, and with sloping sides. All other peoples, from the Samoyeds in Russia to the Eskimo in Alaska, Canada, and Greenland, use sleds with runners drawn by dogs or by reindeer. Most of these people make a variety of sleds; some to ride on, others for packing goods, and others for carrying tent poles. With the aid of these various types, they can transport their entire household goods on their seasonal migrations and can thus accumulate more property than the nomads who have inferior transportation.

Wheeled Vehicles. The wheeled vehicle works on the principle that the wheel transfers the friction involved in traction from the ground to a relatively concentrated point, the axle bearings. Except for the sled with runners operating on hard-packed snow or ice, it is more efficient mechanically than any of the devices so far mentioned, and no more efficient principle of land traction has yet been devised.

Under primitive conditions, that is in regions without paved roads, bridges, and the like, wheeled vehicles are useful in relatively few environments. In the Old World, where they were invented, animal-drawn carts and chariots were mostly limited to the grasslands of Central Asia, to China and India, to Egypt, Mesopotamia, and to Europe. In Central Asia, where they were used in early times by nomadic tribes, people drove large wagons drawn by numbers of oxen overland, without regard for formal roads or trails, just as the pioneers once crossed the American continent with their covered wagons. In mountainous regions without many roads, as in most of the Balkans, North Africa, Afghanistan, Ethiopia, and Peru, wheeled vehicles have been excluded until the last few decades by the restrictions of the environment.

Simple wheeled carts and wagons, built without springs, are not comfortable to ride in; the Homeric heroes at Troy, and the early Irish kings, stood up in their chariots with their knees bent to withstand the bumping and to keep themselves from being thrown out. In Europe people who were able preferred riding on horseback to wagon travel until after the perfection of carriage springs in the eighteenth century. Important as the wheeled

vehicle has been in the transport of goods, its extensive use for human transport is relatively recent.

Before leaving the subject of animal traction, there is one more question which needs to be considered; that of the attachment of the animals to the vehicle. This depends, of course, to a large extent on the kind of animal used, its size and its strength. People who drive dogs need about a dozen to pull a sled efficiently. There are two ways in which they may be hitched; fan-wise, with each dog pulling on a separate trace, as among the eastern Eskimo, or in tandem pairs, as with the western Eskimo and the Siberians. With the tandem pair system, the short, individual traces are hitched to a long strap which runs between the paired dogs from the lead pair to the sled itself. The fan system is good in open country, without trees; the tandem pair technique is more efficient in forests.

Most of the reindeer drivers use two animals, running side by side, each pulling on separate traces; the Lapps, however, harness but a single reindeer to a sled. The habit of hitching two animals abreast is also usual with both oxen and horses. In Central Asia, in Mesopotamia, in Egypt, in ancient Greece and in early Europe, this was almost always the case; even today the Russian droshky is drawn by two horses, as is the Mongol cart. One reason for this is apparently that the horse-driving technique was taken over from cattle-driving, and it is easier to build a cart with a pole and yoke than one with shafts and traces. Furthermore, before modern roads were built, the strength of two or more horses was often needed to pull the vehicle out of ruts and holes.

2. **Operations (Action and Interaction).** The packing, riding, and driving of domestic animals are operations with which the reader is presumably familiar enough so that no elaborate description of these techniques is necessary. It may suffice to say that they are all techniques which require considerable skill and practice before they can be performed efficiently. Most, if not all, are techniques which the single individual can perform alone; there is, therefore, no need of direct interaction. However, people traveling long distances with animals must also be able to care for them at night and feed them; they need to know the ordinary pastoral techniques. Furthermore, it is more efficient for a whole camp or a whole caravan to travel together than for one person alone, since some animals will be used to carry people, others to carry food, others tents or utensils. Also, in a caravan, one person can drive a number of animals, while others may be free to hunt or to guard the procession against marauders. A party of travelers, whether a camp of pastoralists on the move or a commercial caravan, needs some definite organization, with a leader and a division of labor.

The following quotation illustrates this fact as applied to a party of Moors from the western Sahara, including a chief, his followers and slaves. One of the slaves, the author of the passage, was Captain Judah Paddock, an American mariner who had been wrecked on the African coast shortly before.[2] The incident took place in the year 1800.

This night was, as usual, a cold one; we however slept well, till awakened at dawn of day by the noise of the Arabs at their prayers. . . . At about sunrise, their horses were all brought up, bridled, and saddled. . . . Our breakfast was prepared sooner than had been usual, and the sheep, the camels, and the goats were milked. This was a work that had generally been done at 10 o'clock, about which time we had our breakfast, and our supper at dark, that is to say, two meals only in the twenty-four hours. When all this was done, our chief announced his determination to remove their quarters; upon hearing this declaration, the women struck their tents, and began to load the camels with their effects, which consisted of the stakes of the tent, and the lines for securing the lower part of it to the ground, the poles which suspended the top, two wooden bowls, two or three skins for keeping their milk and water in, one or two earthen pots to boil their meal in, a sack to keep their barley in, the stones to grind their grain with, and lastly, the stone for driving into the ground the stakes that held the tent. The old and decrepit, and the small children, completed the load; half an hour being about the space of time taken up by this preparation. The men, all this while were idle spectators of the work which was going on. . . . As soon as the whole was completed, and the word given, the horsemen mounted their noble animals and we all, in a body, moved off eastward.

In contrast to this scene in the life of a group of subsistence pastoralists, let us study the technique of land transportation employed by the commercial caravan men, or "camel-pullers," of northwestern China and Mongolia, who carry quantities of goods from China to the two Turkestans, and back again, over stretches of desert which cannot be crossed in less than a month. These men are full-time professionals, experts in loading and unloading camels, in keeping them from falling sick, in bleeding blistered hoof pads, healing saddle sores, knowing how to feed the animals, and how to get the most miles out of them; masters in a trade which requires a long apprenticeship.

Each man [in the caravan] is in charge of a file of camels called a *lien*. The full number of a lien is eighteen camels, nor can any man be asked to look after more. . . . Every camel has his own place in the file, and on the march he is

[2] Paddock, Captain Judah, *A Narrative of the Shipwreck of the Ship Oswego, etc.*, New York, 1818, p. 65.

always in that place, carrying the same load, unless after consideration a change is made, for some camels when they are tired go better at the tail of the file than up in front. Two *lien* make a *pa,* and in camp these two lien lie either side by side or end-on. The two men, working on either side of the camels as they lie in a row between their packs, help each other to off-load and on-load. Except for this partnership, they have nothing to do with each other; for in camp, when one of them is on duty herding camels or standing watch, the other must by custom be off duty.

At the head of the first string of camels on the march is the chief cook; his title is *kuo-t'ou,* or Head of the Pot. The man who leads the second string has no rank of title; he is there because he is the partner at loading and unloading of the Head of the Pot. Then, with the third string, comes the *erh-t'ou,* or Second Head, the assistant cook. Each caravan fully staffed has two mounted men [the first being the leader of the caravan], and the second mounted man and the second cook are in charge of the water supply. They must find the well, if it lies away from the track, and fill the big water butts, which make more than a standard load and must be carried by the very best camels. When a man is made second cook, he is in the direct way of promotion, for he learns to know all the wells with their supply of water. From second cook he may become Head of the Pot, walking in front of the caravan, setting the pace and learning the road. . . . When he knows the roads as a first-class man should know them, he can qualify as *hsien-sheng,* the second mounted man of a caravan, or even become directly caravan master [who is the first mounted man].

Not all camel-pullers . . . come to be . . . mounted men. Only a few like responsibility or are fit for it. If a man is offered promotion he must usually serve first as . . . [second mounted man]. The term [hsien-sheng] means properly "elder-born," an honorific only applied to literate men. He should therefore be clerk of the caravan. . . .

From the time the caravan halts until it moves again, the . . . [second mounted man] is in charge of the camp. He must watch the pasturing of the camel herd and ride sometimes for several miles to look out better grazing, and he must see to the watering of beasts and the filling of the water butts for men. Between trips, when the camels are at long pasture, he is also in charge. He works hard, doing all the odd jobs, because no camel-puller can be called on for work out of the anciently established routine. . . .

. . . the caravan master . . . is always the pick of the craft. . . . He must not only know the business of camels and the road, but be able to handle the rowdy camel-pullers, who demand dignity without swank, and authority without discipline . . . a man, in short, to interpret the law of their binding customs for the benefit of camel owner and camel-puller. He must also be competent to deal with any Mongol or Chinese officials who may be met, and is responsible in full for the expenses of the journey, including the purchase of provisions for the men and feed for the camels.

If an owner does not accompany his own caravan he sends with it always a supercargo, a member, if possible, of his own family. This man delivers the freight on arrival to the consignees, settles current accounts there with the caravan master, and buys fresh camels if he thinks the investment good. . . . On the road, however, he has no say. The caravan master is then alone answerable for expenses and the conduct of the caravan. He may even, if he thinks it necessary in order to deliver his freight, hire or buy fresh camels. I heard more than once on the way of disputes between owners or supercargoes and their caravan masters; but always it was the caravan master who had his way. . . . In one case the two men did not speak for months, but the caravan master said, "If you do not like the way I lead your caravan, I will hand it back to you at Ku Ch'eng-tze, and you may sack me there; but on the road it is not yours—you are only a traveller—it is mine." [3]

It may be seen from this example that the technique of carrying goods across the Gobi Desert by camel caravan is not simply a matter of loading and leading camels; it is a complex activity which requires the concerted action of a number of men, each of whom is a full-time specialist and who is further specialized in regard to his duties in that particular caravan. It is the pattern of interaction involved, with one man in charge and originating to the others, who respond in terms of their particular techniques, that makes the enterprise a success.

C. Natural Forces

1. Devices. The principal devices used in land transportation through the agency of natural forces transmitted by machines are four: the railroad train; the automobile, including the truck; the electric wire; and the pipeline. All of these should be sufficiently familiar to the reader so that no description of them is needed here.

2. Actions and Interactions. The activities which the crew of a railroad train follow are fully specialized, highly skilled techniques; on a single train are a number of separate specialists, including the engineer, the fireman, the brakemen, and the conductors, who must coordinate their individual actions on an accurate time scale if the train is to be successfully run. There must be one man in charge of the train; he must make the decisions as to when to start, when to stop, whom to allow on his train, and whom to put off; he is like the leader of a Chinese caravan described above. While he is on his train and it is in motion he has absolute authority over the rest of the crew, the passengers, and the freight. If it is a long-distance train especially,

[3] Lattimore, Owen, *The Desert Road to Turkestan,* Little, Brown, Boston, 1929, pp. 121-126.

with sleeping cars, dining cars, and observation cars, the number and the diversity of the specialists under his command will be great. The technique of operating a train, therefore, is more a matter of interaction than of the actual handling of machinery.

In the case of the automobile, the situation is quite different. One person only can drive it, and the only interaction necessary is that between fellow-travelers on the road, who must adjust themselves to each other or suffer accidents. In the case of commercial automotive transportation, however, the situation is different from the non-commercial technique. The cross-country truck has two men, one to drive while the other sleeps. The driver of a cross-country bus is a full-time specialist, who may have a steward with him as crew. On the whole, however, the invention of the automobile and the consequent reduction of travel by railroad and street-car has *lessened* the amount of interaction in transportation and travel, although the total amount of both has increased.

Electric wires and pipe-lines have nothing to do directly with travel, but they are vitally concerned with transport in the modern mechanical age. Electric wires transmit power across country without direct human agency; much of the power used before the power lines were built came from coal and oil shipped by railroad. Pipe-lines carry water from distant reservoirs to large reservoirs to large urban centers; in the Near East other pipe-lines carry petroleum from the Mosul oil fields to Haifa, 700 miles away. In the United States, there are many pipe-lines for oil, crude and refined, and for natural gas. Once the wires are strung, once the pipes are laid, there is no further human activity necessary other than maintenance; and no necessary interaction between the people who furnish the power, water, oil, and gas with the consumer, except through the mail. All of this illustrates the principle that advances in the complexity of mechanical techniques are not necessarily accompanied by advances in the complexity of human interaction; in many cases, the direct result is the reverse.

II. WATER TRANSPORTATION

People who live on the simplest technological levels have no methods of travel or transport by water other than wading and swimming. Even swimming is not universal; there are whole tribes and nations of people who cannot swim. For example, the tropical forest-gatherers of Sumatra, the Kubu and Lubu, and the Punans of Borneo, cannot cross streams too deep to wade. The natives of the Canary Islands, conquered by the Spanish in the fifteenth century, had no boats and could not swim; they had no means of going from one island to another at the time of their discovery. People in

of logs, bundles of reeds, or even a frame with a number of inflated skins tied underneath. The most widespread and important, however, are the log raft and the reed-bundle hull. Log-rafts are used almost everywhere as a makeshift, or secondary means, of water travel. In one region, however, they were developed as an important sea-going device—on the coast of Peru in pre-Spanish times. Here important people were hauled on rafts for short distances by swimmers, just as on land they were carried in litters. In larger rafts, merchants sailed long distances up the coast, carrying goods. These rafts were particularly buoyant, since they were made of the wood of the balsa tree, familiar to most readers as the material used in making model airplanes. It was probably the supply of this unusual wood that permitted this equally unusual raft development.

The reed-bundle hull is in a sense a compromise between a raft and a hollow vessel. In its simplest form, it is made as follows: the builder takes a number of long reeds and arranges them in the shape of a tapering cigar, with the butts of the reeds in the middle and the tops toward either end. Then he lashes this bundle together tightly with cordage. He makes three such bundles, and then binds them all together, side by side, so that the middle bundle acts as the keel and the two outer ones as sides. The bow and stern will be raised. In this way he will have a well-shaped hull, which is flexible and cannot be easily shattered and which is buoyant and easily handled. The only disadvantage is that it leaks, and the sailor is likely to get wet.

Hulls of this kind can be made by anyone with a knowledge of basketry techniques; they may be made without implements, and by one person working alone, who need not be a specialist. Hence it is not incongruous that such simple food gatherers as the Seri and the Californian Indians made them, while the Tasmanians constructed almost identical craft from rolled bundles of the bark of the *ti* tree. In Peru, where good timber is scarce, reed-bundle boats were used, as well as rafts, along the coast; many of them are still sailed on Lake Titicaca.

b. Hollow Vessels. The hollow vessel enjoys several advantages over rafts and floats: the material of its hull can be kept thin; it can be shaped so as to pass through the water with a minimum of resistance; and, owing to its thinness and its lightness per unit of water displaced, a maximum of passengers and cargo can be carried. Hollow vessels may be studied in terms of the number of pieces which compose them, and of the materials used.

Dugouts. The simplest hollow vessels, and the easiest to make, are dugouts, hewn from a single log of wood. The dugout-builder does not need elaborate tools, since he can fell the tree and do most of the hollowing by

fire, dampening the wood at proper moments to prevent it from burning parts to be left. One man can make a dugout alone with a shell or stone adze and fire. The use of dugouts depends largely on the supply of suitable wood. In Negro Africa, the tropical forests of South America, and the interior of Borneo, as well as in the Mississippi valley in pre-Columbian times, all, or almost all, inland water craft were dugouts. They were also used in early times in Europe, and even now may be seen on rivers in the Balkans. Sea-going dugouts, however, must be large enough to withstand rough water, and these can be made only where large enough trees are available. Thus the Indians of the Northwest Coast and the New Zealand Maori made huge sea-going dugouts, some nearly 100 feet long; the Hawaiians made large ones from logs which drifted down from British Columbia. These huge sea-going dugouts, however, were not made by one man with an adze; they were made by teams of skilled craftsmen who were specialists. They were not used to carry one man alone, or one man and his family; they were communal property and carried large companies of traders or warriors.

Bark Canoes. In boreal forests, an abundant supply of birch bark furnishes excellent hull-making material. Hence throughout Canada, in Maine, and in parts of Siberia, the aboriginal inhabitants made light, flexible, and easily handled canoes of this familiar substance. As a rule, the Indian who makes canoes can make two each summer, that is, it takes him about six weeks to build one. He strips the bark, and soaks it under water, at an earlier time; during the actual building process, he cuts the pieces and makes the frame, ties or pegs it in place, and his wife sews the pieces together with split spruce root. Sometimes two or more women work together at this. Thus it takes a team to make a canoe efficiently, with a sex division of labor, although one man could make the whole thing alone without difficulty if he had to. The bark canoe, despite its perfection and beauty, must always be a small craft, suitable for two or three persons, since the hull material is not rigid. The same is true of beech bark, which is somewhat stiffer than birch; this was used by the Yaghan Indians of Tierra del Fuego.

Skin-Covered Boats. There are two kinds of skin-covered boats, used in two different environments for different purposes. One is the bull-boat, an ox or buffalo hide cover stretched over a circular frame of withes, used to cross rivers; the other is the skin-covered kayak and umiak and related boat types used by polar peoples. The bull-boat is used in Mesopotamia, where wood is scarce; it was also used by the Plains Indians for crossing the Missouri and other rivers. In the Plains area, these boats served a double purpose, since when not in use they were placed upside down over the smoke holes of earth-lodges, to keep out the rain in stormy weather.

There are two varieties of polar skin-covered boats; the kayak, with a covered deck and enclosed cockpit, and the umiak, a large open boat with a wooden frame covered with a split walrus hide and capable of carrying a dozen people and much goods. The kayak has the advantage that it cannot ship water; the skilled operator can turn over under water and come right-side up again. It has the disadvantage that the skins must be taken off and dried frequently, and frequently examined for leaks. Since, like the bark canoe, these boats are made with a non-rigid cover material, there is a definite limit to their possible size.

Plank Ships. Aside from the huge dugouts previously mentioned, which can be made in a few special environments only, most large ships used on long voyages have been made either of planks or of metal. The plank ship, in its simplest form, consists of three pieces of wood, a bottom and two sides. Such three-piece craft were made aboriginally by the Chumash Indians of California, under a special combination of circumstances. They could obtain large cedars, suitable for making good sea-going dugouts, in the Sierras miles from the sea. They could not, however, transport these tree-trunks overland, and hence they split them into planks, which they carried by hand to the shore, where they assembled them into hulls.

Aside from the Chumash canoes and similar craft elsewhere, all large, sea-worthy plank ships are built with a keel and framework, although there are many transitional forms, particularly in Polynesia, which consist of a narrow dugout to serve as keel and plank sides. Sea-going plank ships are limited to the waters of the Old World. They include the ships of the ancient Egyptians and of the Mediterranean sea-faring peoples, including the Phoenicians, and those of the early Scandinavians, who got them first from the Mediterranean. They also include the Arab vessels which sail the Red Sea and Indian Ocean, the Malay praus, and the Chinese junks. Such ships not only carry passengers and goods between the ports of populous nations, but are also used extensively in fishing and whaling.

Multiple Hulls and Outriggers. There are two ways to make a hull sea-worthy, so that it will not tip over easily; one is to keep the hull broad enough in the beam, and the other is to lash two hulls together or use outriggers; in other words, to use the principle of the catamaran. The principal area of the world in which double hulls and outriggers were used is Polynesia. Out on the Pacific, the Polynesian navigators had to have seaworthy ships in which to make extensive voyages, on some rare occasions even a thousand miles long, in all weather; they had only stone and shell tools, and little wood suitable for planking and frames. Instead of developing broad, seaworthy hulls with inside ballast, they devised the system of attaching out-

riggers to one or both sides of the hull by booms. These outriggers permitted them to sail close to the wind without capsizing, and to operate in shallow water, which was important in crossing coral reefs at the entrances of lagoons. The double ship, used in great migrations, had the advantage that a platform could be built over the connecting booms, and the baggage and passenger space thus increased.

Iron Ships. The metal hull is a product of the last century, and one of the many facets of the application of power to industry. It has several points of superiority over the wooden hull: the material of which it is made is abundant, if not inexhaustible, while good shipbuilding wood is expensive and scarce; the units of which it is made can be mass-produced, since molten steel is a plastic, and can be turned out in uniform sizes and shapes, while wood must be seasoned, sawed, planed, and adzed; the plates can be riveted or welded together quickly, whereas the action of pegging and bolting is longer and more tedious; the hull is stronger than a wooden hull, and there is no theoretical limit to its size. Furthermore, it can stand the vibrations and strains of an engine better than a wooden hull. It is fireproof. It can even be so constructed that it can go under water, which gives us the submarine.

2. Means of Propulsion. In previous studies of technological processes, we have made a primary classification on the basis of three sources of power; human muscle, animal muscle, and the energy of natural forces operated by machines. In the case of ships, however, this basis must be changed; the three important sources of power, which have a definite developmental significance, are human muscle, wind, and natural forces operated by machines.

a. Human Muscle. There are three principal devices for propelling vessels by human muscle: the pole, the paddle, and the oar. The pole is the only one known to some of the simpler navigators, such as the Tasmanians and the Seri; it is also useful, however, to people operating boats in shallow water anywhere. In Canada, for example, the Indians use the pole much more than the paddle in swift, shallow streams, especially those with rapids.

Canoe people everywhere use paddles in waters too deep for poling. The oar is a more advanced device, since it utilizes the principle of leverage with a fixed fulcrum on the gunwale. It is to the paddle mechanically what the spear thrower is to the arm alone. Oars are used chiefly for voyages on the open sea, and mostly with plank-hulled ships; they are the characteristic means of propulsion, along with sail, in the Mediterranean, in the Baltic and the North Sea, in India, China, and Japan. In the New World, the Greenland Eskimo were the only people who knew them.

With oars, it is possible to operate a ship of considerable size, such as

the galleys and caravels of the Middle Ages. There is, however, a limit to the length of the oar which rowers can handle, since the efficiency of this means of propulsion depends to a certain extent on the ratio between the length of the oar and the size of the ship; there is likewise a limit to the possible size of the hull. The *Queen Mary* could not be propelled efficiently with oars, no matter how many were thrust through her sides. There is a great controversy going on, which does not seem likely to be solved immediately, concerning the Roman triremes, with their three superimposed banks of oars. Some experts hold that this was impossible, and that the meaning of the word "trireme" has been misinterpreted. Whatever the answer, it seems likely that no more efficient rowing ship has ever been made than the old Viking ship with its hull one hundred feet long, and its thirty or forty pairs of oarsmen. The ships in which Leif Ericsson crossed from Norway to Vinland were more seaworthy than those of Columbus.

The rowing ship has other limitations than that of size; it must have a large crew, and since the work is arduous, this crew must be accompanied by a number of soldiers to keep discipline. The crew must eat, and its food and water take up much of the cargo space.

Besides poles, paddles, and oars, there is another device which may be used to propel ships through human muscular force; the tow line. In China, it is a common practice for large gangs of workmen, as many as several hundred, to tow large barges along canals or up rivers. In Egypt, this technique is also used sometimes. It can only be profitable in regions where people live on the basis of intense agriculture with simple hand techniques, and in which there is a large, poor population. It may also be extended to domestic animals, however; the Eskimo occasionally use sled dogs in the summertime to haul umiaks alongshore, and in the United States, the barges on the Erie Canal were, during the early part of the last century, hauled by horses driven along the tow-paths. This use of animal power has not the same importance or significance in the case of water transport as it has with land travel.

b. Wind. Sailing is definitely a more advanced technique than paddling or rowing. It takes more skill, more knowledge, and, except momentarily, less muscular exertion. It utilizes a force far stronger than any combination of human or animal muscles. Fewer men are needed to operate a sailing ship than a rowing ship of equal size and cargo space. However, there is a great variety in sails and in sailing, and some of the cruder sails and techniques are not adequate to carry ships safely on open seas.

For example, the ancient Egyptians, the Homeric Greeks, the Phoenicians, and the Vikings used a square sail hung from the mast on a yard,

with the lower border free; the sail was fastened by braces to the ends of the yard, and two sheets, one to each of the lower corners of the sail. The ancient sailors who voyaged in these ships could not tack in them, not because this type of sail will not permit it, but because the hulls of their ships were too shallow and had too little keel. Therefore they hoisted the sail only in a fair wind, and for much of the time the sailors propelled these ships with oars. Thus these ancient ships depended as much on rowing as on sailing; the sail gave the oarsmen an occasional rest from their onerous labor. Square sails, rigged in this way, are still used on Chinese junks, which are well ballasted and require no rowing. The Eskimo and Northwest Coast Indians, the only sailors in North America, used the single square sail on umiaks and dugouts, which could also be hand propelled.

In Western Europe and the Mediterranean, medieval sailors developed large ships with several masts and rows of smaller square sails which could be set more easily than one large one. This principle produced the extremely efficient full-rigged ships of the eighteenth and nineteenth centuries. In the Red Sea and the Indian Ocean, a variant system, the lateen rig, was developed, probably at an earlier time; this consists of a triangular sail with a slanting yard and a sheet from one corner of the sail only; in order to tack a ship equipped with such a sail, it is necessary for the crew to lower the sail, carry its peak forward around the mast, and make it fast on the other side. This lateen rig spread out historically into the Polynesian Islands, and also up into the Mediterranean. Early Portuguese vessels bore both square and lateen sails, and the latter developed into the modern fore-and-aft rig. The chief advantages of ships so equipped are that they can be sailed to windward more efficiently, that fewer men are needed to handle the vessel, and hence they are more economical to operate than full-rigged ships. Its relative ease of operation and greater speed to windward make the fore-and-aft rigged ship the best for coastwise navigation, while the full-rigged ship is better for long ocean voyages, because of the fact that a square rig is more efficient and less dangerous with a following breeze.

c. Machine-Operated Forces. There are but two other sources of power which have so far been applied to machine-operated ships; the steam engine and the internal combustion engine. Owing to the slowness and imperfection of the first steamships, which appeared during the last century, and because of the amount of space occupied by engines and fuel, their advantage over the fast clipper ships was not at first apparent. However, once the steam turbine was developed, the speed increased; further improvements included a reduction in engine size and fuel consumption, so that the loss of cargo space was eliminated. The most important advantage of steam over sail is

that the ship is no longer dependent upon variations in the force or direction of the wind; there are no days and weeks when the ship lies idle in a calm, and there is much less danger from storms. The steamship can set a course and keep to it; the sailing ship must tack and thus travel farther.

B. Actions and Interaction

In a small raft or canoe, operated by a single man, the action is simple and interaction absent, but most kinds of boats and ships, however propelled, require the services of two or more persons, and these persons not only have to perform skilled operations but also act in concert. Let us take for a simple example two men paddling a canoe—most of the readers have probably had that experience. The man in the bow paddles on one side of the canoe, the man in the stern on the other. If one gets tired and wants to shift sides, he must tell the other man so that they can both shift at the same time. The man in the bow takes simple strokes, but the man in the stern has to twist his paddle at the end of each stroke to keep the canoe on a straight course, and by steering to one side he fails to twist it, and steering to the other he twists it more, or he may stop paddling to use his instrument as a rudder. He may call out to the man in the bow to change sides quickly, or to paddle harder, when the canoe needs to be turned quickly.

If the two men are taking the canoe down a swift stream over rapids, the man in the bow may stand up, with his legs carefully braced, to look for the rocks ahead, some of which lie just under water. He calls out to the man in the stern, "Right! Hard left! Easy, take it easy! Right!" In response to these calls, the man in the stern makes thrusts of varying intensity with his pole, and thus keeps the canoe from hitting rocks which he himself cannot see, while the man in the bow uses his pole only in case of emergency.

The act of poking the bottom of a stream with a pole may seem superficially a simple one, but the ability of two men to guide a canoe down a rocky stream by this means is highly skilled and technical; the factor of importance is *time* in relation to distance, and in relation to the accuracy with which the two men interact.

This may be more forcefully illustrated by the example of a college racing crew in a shell. The crew consists of eight oarsmen and a coxswain. The number one oarsman, sitting nearest the stern, is the stroke. The others must keep stroke with him. As a rule, the poorest oarsmen are placed nearest the bow, and ability as an oarsman depends more on ability to keep stroke than upon muscular energy or endurance, although both are important. The coxswain has two duties: to steer and to call out the stroke. "In! Out! In! Out!" he cries over and over in perfect time; when the shell lags in

a race, the captain will tell him, "Put up the stroke!" and he decreases the time interval between his shouts. Muscular force is a disadvantage in a coxswain, since he must be as light of weight as possible.

The same principle is true in a great war canoe, such as the New Zealand Maori and the Fiji Islanders used to operate. The crew would be a large one; there might be as many as a hundred paddlers, who would have to keep perfect stroke to the shouts of a coxswain. By this means, they could spurt through the water and plow the keel of their canoe onto the sand of a hostile shore, seize their weapons, and leap onto the beach ready for battle. In the medieval galleys, where the oarsmen were slaves and political prisoners, lashings rewarded the man who fell out of stroke. Since the basis of timing in operating such ships is rhythm, paddlers and oarsmen everywhere tend to sing as they row or paddle. In the slave galleys, there was a special man who beat the stroke with a hammer on a drum or on some other resonant surface.

In a ship propelled solely by paddles or oars, there is, as has just been stated, a necessity for intense interaction between the members of the crew in terms of accurate timing, but there is only one kind of interaction, and that is concerned with paddling or rowing. The crew may consist wholly of specialists, but most of them are specialized in the same activity. The only exceptions are the captain, who is in charge and tells the others what to do, the man who calls out the stroke, and the helmsman at the steering oar. In small ships, the captain may take over most of these duties himself.

In a sailing ship, on the other hand, not only are all men ordinarily specialists, but they specialize in more varying activities. There are the captain, the mates, the seamen organized into the different officers' watches, the cook, the mess boy, the cabin boy, the ship's carpenter, and often a purser or supercargo who is the owner's representative. There may even be a ship's doctor. On such a ship, the captain is in supreme command; he can jail crew members and passengers in the brig; until recently he could have the members of the crew flogged, or hang them for mutiny. As with the Central Asiatic camel caravan, his authority is superior to that of the owner, or of the owner's representative, the supercargo, whose authority is confined to buying and selling cargo in ports.

The members of a sailing ship's crew may not interact as constantly at a fixed rhythm as do those of a rowing galley, but the activities of hauling anchor, setting sails, picking up mooring, etc., require just as good timing if they are to be successful, and just as much authority.

The complexity of the interaction and timing required in handling a

sailing vessel is well illustrated by Richard Henry Dana, Jr.'s, description of tacking the ship *Pilgrim,* in his classic work.[4]

The second day out, the wind drew ahead, and we had to beat up the coast; so that, in tacking ship, I could see the regulations of the vessel. Instead of going wherever was most convenient, and running from place to place, wherever work was to be done, each man had his station. A regular tacking and wearing bill was made out. The chief mate commanded on the forecastle, and had charge of the head sails and the foreward part of the ship. Two of the best men in the ship—the sailmaker from our watch, and John, the Frenchman, from the other, worked the forecastle. The third mate commanded in the waist, and, with the carpenter and one man, worked the main tack and bowlines; the cook, ex-officio, the fore sheet, and the steward the main. The second mate had charge of the after yards, and let go the lee fore and main braces. I was stationed at the weather cross-jack braces; three other light hands at the lee; one boy at the spanker-sheet and guy; a man and a boy at the main topsail, top-gallant, and royal braces; and all the rest of the crew—men and boys—tallied on to the main brace. Every one here knew his station, must be there when all hands were called to put the ship about, was answerable for every rope committed to him. Each man's rope must be let go and hauled in at the order, properly made fast, and neatly coiled away when the ship was about. As soon as all hands are at their stations, the captain, who stands on the weather side of the quarter-deck, makes a sign to the man at the wheel to put it down, and calls out "Helm's a lee'!" "helm's a lee'!" answers the mate on the forecastle, and the head sheets are let go. "Raise tacks and sheets!" says the captain; "tacks and sheets!" is passed forward, and the fore tack and main sheet are let go. The next thing is to haul taut for a swing. The weather cross-jack braces and the lee main braces are each belayed together upon two pins, and ready to be let go; and the opposite braces hauled taut. "Main topsail haul!" shouts the captain; the braces are let go; and if he has taken his time well, the yards swing round like a top; but if he is too late, or too soon, it is like drawing teeth. The after yards are then braced up and belayed, the main sheet hauled aft, the spanker eased over to leeward, and the men from the braces stand by the head yards. "Let go and haul!" says the captain; the second mate lets go the weather fore braces, and the men haul in to leeward. The mate, on the forecastle, looks out for the head yards. "Well the fore topsail yard!" "Top-gallant yard's well!" "Royal yard too much! Haul into windward! So! well that!" "Well all!" Then the starboard watch board the main tack, and the larboard watch lay forward and board the fore tack and haul down the jib sheet, clapping a tackle upon it, if it blows very fresh. The after yards are then trimmed, the captain generally looking out for them himself. "Well the cross-jack yard!" "Small pull the main top-gallant yard!" "Well that!" "Well the

[4] Dana, R. H., Jr., *Two Years Before the Mast,* Boston, 1840, Chapter XXIII, pp. 181-182 (Harvard Classics edition).

mizzen top-gallant yard!" "Cross-jack yards all well!" "Well all aft!" "Haul taut to windward!" Everything being now trimmed and in order, each man coils up the rigging at his own station, and the order is given—"Go below the watch!"

The operation of a steamship is even more complex than that of a sailing vessel. On the steamship, there are two separate departments, the navigating and the engineering; the captain is in charge of the first, the chief engineer of the second. The engineering branch of the crew, including the assistant engineers, wipers, oilers, etc., take orders directly from the chief engineer and not from the captain, who has charge of the mates' watches. Under him are also the chief steward, with his cooks, stewards, etc., while the purser, who is agent for the owners, is comparable to the supercargo on camel caravans and on sailing vessels. A modern passenger ship carries such diversified specialists as manicurists, florists, musicians, and printers; it is a complete city of its own in which the passengers see little or nothing of the officers, and in which there are so many crew members that they do not all know each other, although each individual interacts in a standard way with those above and below him, and with those who perform the same activity as his.

Although water is not man's natural medium, the mastery of the techniques of sea transportation has given those individuals who use them more power than the mastery of travel over land. The chief reason for this is that the bulk of the earth's surface is covered by water. People traveling by land sooner or later meet barriers which they cannot cross; people who travel by sea can sail to any continent or island. In the development of trade between different environments, in conquest, in colonization, and in all the activities which have brought about the modern commercial age, the mastery of the sea has been the key.

Seafaring has one other advantage, however; that is the discipline that it inculcates. Men who have been to sea have been conditioned to give and take orders at the proper time, to work together, to interact in an orderly fashion. Many unruly young men, "spoiled" as children, have been sent to sea, and have returned home with better adjusted personalities.

III. AIR TRANSPORTATION

Air transportation is so new that many people still living were fully mature at the time the Wright Brothers performed their first successful flight at Kitty Hawk. Nevertheless, it has been developed and perfected so rapidly that it rivals sea transport as the most important method of transportation at present practiced. Its great advantages over both land and sea travel are that it is many times more rapid than either, and that it needs no roads or

tracks, no canals or docks, and that it is impeded by no barriers on earth except those which affect taking off and landing: fog and rain, and rough land and sea surfaces.

It would be futile to describe here the devices used in air travel; they are known in detail by almost every American born since 1915, and by many who are older. It is sufficient to state that only the third of our three sources of power, *natural forces operating through machinery,* is involved. The action of operating an airplane is a highly technical one, and requires an expert, if not a full-time professional; only full-time professionals are allowed to operate planes carrying passengers or freight commercially. There are small planes in which one pilot flies alone, but the great commercial planes, which carry over forty passengers, as, for example, the Clippers flying across the Atlantic and Pacific and down to South America, have crews of over a dozen men, including pilots, navigating officers, radio men, engineers, and stewards. The discipline on a large airplane is as strict, the authority as absolute, as that on a battleship. The timing must be equally accurate; when things go wrong, they happen very quickly. The personnel of such a ship must be composed of superior men, who can give and obey orders and make decisions rapidly, and who can enforce discipline on the passengers in case of trouble. Air training is as excellent a conditioning process as old-fashioned sea-faring.

SUMMARY

Transportation consists of the techniques of moving people and goods by land, water, and air. The most simply adjusted peoples walk by land, and either avoid the water or cross small bodies of it in rafts or reed-bundle vessels, and know nothing of air travel. In certain environments aids to walking have been invented, such as the snowshoe and ski in the boreal forests and polar lands of the northern hemisphere. These devices facilitate hunting and herding in landscapes which would otherwise be difficult if not impossible to exploit by these techniques.

The domestication of animals makes a great advance in the efficiency of land transport. Different animals are used in the special landscapes to which they are adapted, as the camel in deserts and the reindeer in boreal forests, and are used with suitable devices in each area. Packing is the most efficient technique in some environments, sled-hauling in others. Wherever there are smooth surfaces, either grassy plains or prepared roads, wheeled vehicles are the most effective.

The invention of the wheel made it possible for a third source of power to be utilized—that of natural forces such as the expansion of steam and

other gases, and thus brought in the modern age of land transport with railroads, automobiles, etc. It had a further importance to the development of technological complexity in that with the principle of the wheel people were also able to apply water power, wind power, steam, etc., to manufacturing machinery.

In sea transport the three stages in the use of forces are human muscle, with paddles and oars; wind, with sails; and machine power, with steam, Diesel oil, etc. In the air only machine power has been used. Sea transport (and air transport) give the people who use them a mastery over the trade routes of the world and permit the development of complex economic and political institutions.

The operation of a ship, a camel caravan, or a train is a complex technique requiring specialized timed interaction, in which different individuals perform different parts of the technique in concert. It also requires a development of strong authority, and is a prime means of developing discipline, i.e., ordered patterns of conditioning in human relations, as well as complexity in institutions.

Transportation in general increases in volume with the increase in production of surpluses of goods, and is an extremely important factor in the development of complexity of human institutions, since it provides one of the primary means not only of trade but also of interaction in general.

CHAPTER 10

Techniques, Technologies, and Environment

I. TECHNOLOGY: THE INTERRELATION OF TECHNIQUES

In the last four chapters we have seen how people living in different environments are able to adjust themselves through the agency of each of the more important techniques, in order to obtain food and other needed materials, to process these for consumption and use, and to transport their persons and belongings by land, sea, and air. Our present purpose is to show how different peoples combine their various techniques into total adjustments, which we shall call technologies.[1]

The different techniques employed in a single technology are all related to each other in some way, since they are practiced by the same individuals or by individuals who are mutually dependent upon each other. For example, if a man uses water power in a mill to grind grain, he can also use it to saw wood or to operate a loom. An Eskimo who knows how to sew skins to make a suit of clothing, can also sew them to make a canoe cover. People who can make a ship out of lumber can also build houses with the same materials and tools; those who use steam engines in railroad trains can use them in ships as well.

If we examine the technology of any people, we will find that it consists of a special combination of techniques which may not be exactly repeated elsewhere; technologies vary in terms of environment, and also in terms of the special combinations of principles utilized, and the variety is, of course, very great. It is not our purpose to describe all of the existing combinations, but to show the principles by which different techniques limit and control each other.

If we examine the various techniques which we have described in the preceding four chapters, it becomes apparent that three are of paramount importance in determining the nature of the others. The three key tech-

[1] We prefer this word to the more commonly used term "economy," since the latter word has many other connotations which in the present work would confuse the issue.

niques are (1) the types of cutting tools used, (2) the methods of obtaining food, and (3) the methods of transportation.

There are three kinds of cutting tools which limit other types of activity: (a) chipped flint, (b) polished stone, and (c) metal. With a chipped flint blade, a hunter can skin an animal and cut up the meat easily and quickly; there is no better knife for this purpose than a flint one. A man can scrape the hide with a flint flesher, or with a bone one carved with a flint tool; he can cut the hide into pieces to make a tailored garment, and sew it with bone needles, again fashioned by means of flint. When it comes to wood-working, however, the man dependent on chipped flint alone encounters a serious difficulty. Flint is not as good for wood-working as for cutting meat or skins; in contact with wood, the razor-sharp edge of a fracture-surface of flint, obsidian, or glass quickly chips away, and it is necessary to use relatively dull, obtuse or right-angled fracture edges; the characteristic woodworking tool of flint is a snub-nosed scraper. An Australian aborigine can cut down a one-inch sapling with a flint blade, and he can scrape and gouge it into the form of a spear-thrower or a spear; if you look at any Australian spear, throwing stick or boomerang, in a museum, you will see that the surface is finely corrugated from this scraping. With this kind of tool, the Australian could not make a large or elaborate wooden object that took much cutting, like a plow or a ship.[2]

The man equipped with a good polished stone ax or adze can, in contrast, cut down trees, hew out planks, build ships and plank houses, hollow out canoes, and make many other complex objects of wood. He can, furthermore, so shape individual pieces of wood that they will fit well together. If he is a farmer, he can cut down the trees on his arable land and burn them.

The man equipped with a metal ax can, however, cut down a tree in a fraction of the time it took the man with the stone ax; he can saw the trunk into many planks in an even smaller fraction of the time that it took the stone-ax worker to hew it into one or two. Aside from the time factor, the chief difference between metal and stone tools is that since metal is a plastic, it can be fashioned into many kinds of tools; with polished stone, only axes, adzes, and chisels are possible. Metal drills are much more efficient than chipped stone drills, and there is no adequate stone equivalent of a saw. In New Zealand and on the Northwest Coast, both centers of woodworking art, most of the elaborate carvings now found in museums all over the world were made *after* the natives had obtained metal tools. With metal tools, it is also possible to cut stone with relative ease, and the time

[2] The tribes in Australia that make wooden shields and dugout canoes, actually use polished stones axes.

saved is a considerable item. The stone edifices of Central America, which as we have seen were built from blocks quarried by means of stone tools, required an enormous expenditure of human muscular energy and time. The most important thing about metal tools, however, is that once people know how to smelt, cast, and forge, they can make many different kinds of machinery with it. With metal machinery, furthermore, they can process materials with maximum efficiency, and can also harness great sources of natural power, such as the expansion of steam, the expansion of gases in motors, and electricity.

Methods of Obtaining Food. There are two principal techniques of obtaining food, by the acquisition of natural products, i.e., gathering, and by husbandry. For present purposes we have divided the last into its two component elements; agriculture and animal husbandry. Thus we have three techniques to use as variables: (a) gathering, (b) agriculture, and (c) animal husbandry. Each of these three permits a maximum utilization of the landscape for food in different environments; there is no linear progression from inefficient to efficient, as in the case of cutting tools. However, in most environments, techniques of husbandry permit a larger population per square mile than techniques of gathering, for reasons which we have already explained.

There is, of course, a definite relationship between these techniques of food acquisition and the different kinds of cutting tools. In the first place, the only technique of food acquisition possible without any cutting tools at all is *collecting,* a gathering technique. No people living or extinct has been known to practice this technique alone. In the second place, people using only flint cutting tools never practice agriculture or breed any animal other than the dog. Theoretically, it is possible to plant grain by hand with a simple digging stick in country which does not require tree-removal, and to reap it with flint sickles, or with clam shells, but actually there is no evidence that this has ever been done. All techniques of higher agriculture, above this hypothetical simplest level, require the use of either polished stone or metal tools. In tropical forests, the farmers must, as we have seen, fell the trees and burn them. In open country, as in Egypt, Mesopotamia, and the Missouri valley, the best land, and in fact the only land capable of cultivation by simple methods, lies along the river banks, and here there are water-loving trees which the farmers must remove before they can plant their crops. In Egypt, the earliest agriculturists cut down this riverine forest with stone axes, as preserved stumps still testify.

Aside from tree-felling, the farmer needs a number of tools, such as hoes, rakes, and flails, and storehouses in which to keep his harvested crop.

If he has domestic animals suitable for traction he must also make a plow, perhaps a harrow, and also a sled or cart. The man who makes any of these things requires good cutting tools of the polished stone or metal type. Still better, however, is a plow with a metal share; the full development of metallurgical techniques makes it possible for the farmer to use a steel plow, a disc-harrow, and a tractor.

The relationship between cutting tools and animal husbandry is similar to that described above. Theoretically, people should be able to raise domestic animals with no implements other than cordage and simple sticks, and a few simple containers such as gourds for the milking, but actually no people without advanced cutting tools have ever been found keeping domestic animals as a source of food. The Nuer of the Sudan, who use the simplest possible equipment in their cattle-herding, have iron. The Eskimo use polished stone or iron implements to make their dog-sleds and harness. The Chukchi have presumably had a few iron cutting tools as long as they have had domestic reindeer, and the same may be true of the Lapps. In other words, good wood-working tools are necessary for any but the simplest possible exploitation of domestic animals.

Techniques of Transportation. Every human being who is physically normal and who has been brought up with other people, walks and can carry objects around with him. As we have already seen, a number of men together can carry a heavy object, and this is a normal procedure in some regions. For our purposes, we shall include all methods of transport which are dependent upon the human feet under the heading of *foot transport,* as distinguished from the use of animals, traction devices, and machine-powered vehicles, which we shall call *advanced land transport.*

The relation between cutting tools, type of food acquisition, and methods of land transport should be clear. People who use chipped flint implements only cannot make carts, bicycles, or automobiles; they have, as we have already seen, no domestic animals other than the dog, and their transport by land is limited to foot transport. On the water, however, the story is different. The Seri Indians of Mexico made seaworthy reed-bundle rafts by a simple basketry technique, which required no cutting tools at all; the Tasmanians did the same with rolled bundles of ti-bark. The Canoe Indians of Tierra del Fuego made excellent beech bark canoes with chipped flint implements only. Thus it is possible to make navigable craft, both rafts and canoes, seaworthy enough for fishing trips offshore in the ocean, on the technological level of flint chipping and food gathering. Two of the peoples who are commonly referred to in anthropological literature as among the

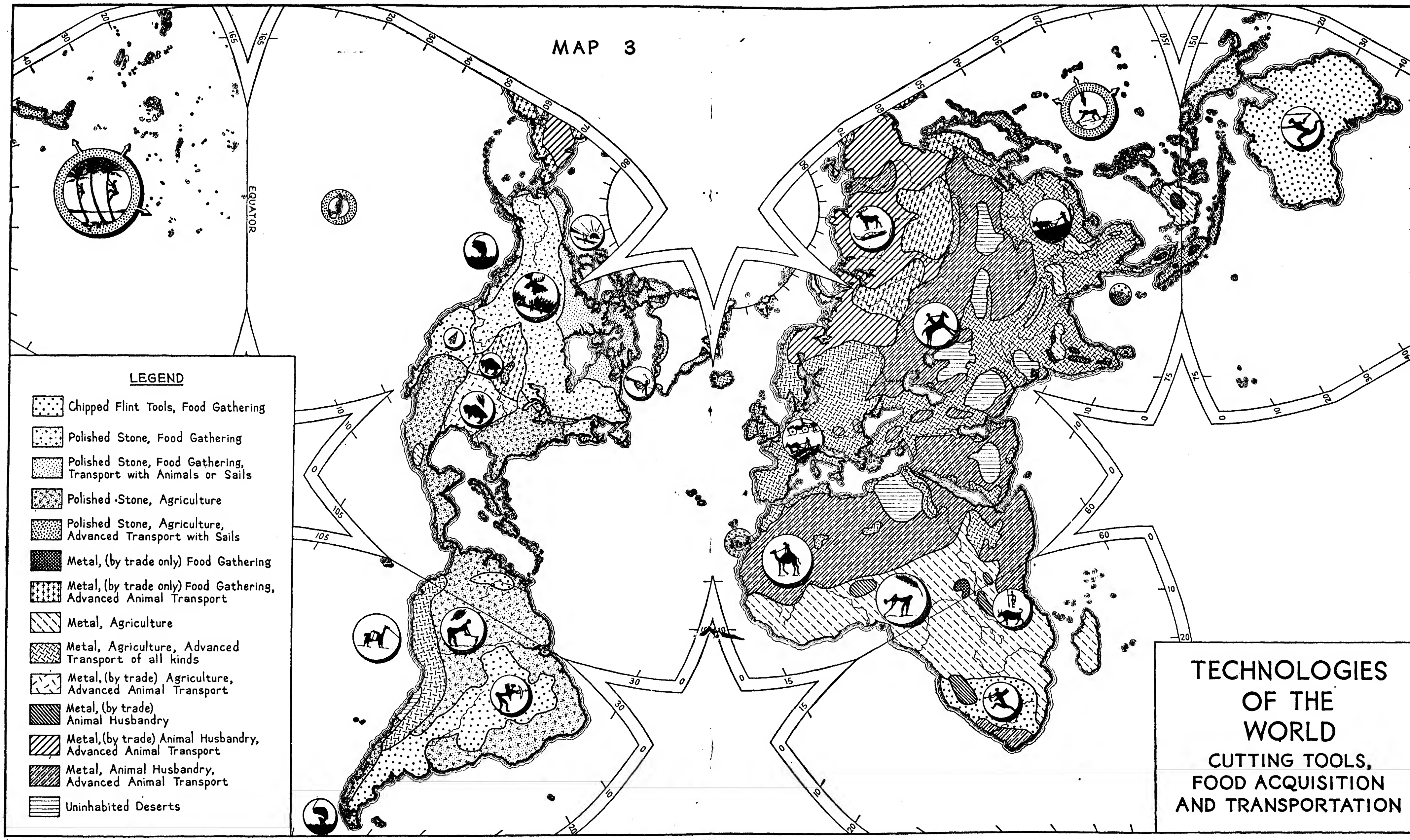
world's most primitive, the Tasmanians and the Yaghans of Tierra del Fuego, possessed this combination of techniques.

With polished stone implements, great advances can be made in transport; the Eskimo make dog sleds and excellent boats with them; the Polynesians built their great seagoing sailing ships, which were a hundred feet long, with adzes of stone and tridacna shell. There is no evidence that anyone ever made a wheeled vehicle with polished stone tools, but theoretically it is possible. With metal tools, of course, craftsmen can build ships more easily, more quickly, and with less labor in terms of time-per-workman than they can with polished stone. They can also build good wheeled vehicles. What is even more important about metal, however, is that they can make parts of the ships and parts of the vehicles themselves out of metal by the techniques developed originally for tool-making.

Methods of transportation are also intimately connected with techniques of food acquisition. The hunter who travels on foot cannot cover as wide a territory as the hunter on horseback, or on the back of a reindeer; the hunting techniques of the Plains Indians, who rode horses, differ greatly from those of the Australians. In the grasslands of South America the hunting techniques of the Tehuelche and Puelche Indians changed profoundly after they acquired horses. They gave up the bow and arrow and adopted the bolas, and they rode down their game instead of stalking it. Sea-fishing is particularly dependent on good transportation; the vast riches of the Grand Banks remained unexploited before the invention of good transatlantic sailing ships. The same is true of whaling and commercial sealing.

In the field of agriculture, specialized commercial crop growing is able to develop only when the farmers can send their produce to market quickly and cheaply, in good horse-drawn wagons, railroad cars, and trucks; before these methods of transportation were devised most farmers had to plant their land with subsistence crops, intended largely for family consumption. We do not know which was invented first, the plow or the cart, but whichever was the case, the two devices are closely related since both require the use of traction animals. When this principle of traction is extended to the harrow, the horse-drawn rake, and the tractor, the farmer is able by his own efforts to cultivate a much larger area of land in a day's work than the more primitive agriculturists with only a wooden plow and a pair of oxen; the man with the wooden plow and oxen, furthermore, can get much more out of his land per unit of labor than can the slash-and-burn farmer.

Transportation and animal husbandry have a direct and obvious relationship; people who breed horses, oxen, camels, donkeys, and the like, possess means of animal transport. On the other hand, people who raise pigs



The techniques selected to illustrate the different technologies of the world represent the most characteristic activities of each particular area. They therefore differ from area to area even though the technological levels may be the same. There is, furthermore, no uniformity as to whether the symbol represents cutting tools, food acquisition, or transportation. The test for selection in all cases is one of familiarity and distinctiveness.

and hens are no better off in this respect than farmers who have no animals; carrying pigs and hens to market is just as difficult as carrying bushels of grain and turnips, if not more so, since the pigs and hens may escape.

Advantageous as animal transport is, however, machine transport is even better; before the invention of the railroad and the automobile, the transport of goods by land was dependent on animals. Now the animals themselves are transported by machine. Fifty years ago, cowboys used to drive steers from Texas to Wyoming; in the days of Sir Walter Scott, drovers brought cattle on foot from the highlands of Scotland to sell in England; today these animals are shifted about by truck and train.

Other Techniques. From the foregoing, it is apparent that the basic techniques of tool-making, food acquisition, and transport are mutually dependent and mutually limiting. It would be possible to draw up an elaborate scheme showing the details of these relationships; our present purpose, however, is merely to make it clear that these relationships actually exist, and that they further influence other techniques. For example, the techniques of making pottery on the potter's wheel, grinding grain in rotary mills, and operating sewing machines are all related to each other and to the techniques of land transport by domestic animals and wheeled vehicles; they were all devised by people familiar with the operation of shafts and wheels. For our present purposes, it is not important who discovered this principle, or whether the potter's wheel or the cart came first; what is important is that people who have understood it have applied it to all sorts of machinery, and that they have thus made possible the utilization of natural forces—water power, the expansion of gases, and electricity, upon which our modern world civilization depends.

II. TECHNIQUES OF FACILITATING AND REGULATING TRANSPORT

Another excellent example of the interrelation of techniques is the manner in which different peoples regulate travel and transport by land, sea, and air. In Chapter 9 we studied the actual machines and techniques of moving people and goods in these three media; we must remember, however, that this is not the whole story of transportation; that building an automobile and driving it from place to place are not the beginning and the end of motor transport; the driver must have a road to follow which has been built by engineers, and on the road he must stop at red lights, have his gasoline supply replenished at filling stations, and occasionally get out to eat. When he comes to rivers, he must cross these on bridges; sometimes he must resort to ferries to cross a bay or large estuary. People who travel by

sea need docks and harbors to ensure safe landings and embarkations, and corps of stevedores are necessary to load and unload the ship. Airplanes similarly need landing fields, and for every pilot and co-pilot and stewardess in the air, there are a dozen or more people engaged in the ground technique of air transport. In the three examples we have given—the automobile, the modern ship, and the airplane—the interrelation between the techniques of transport and other techniques are complex; in the case of simpler transportation techniques, the interrelations are also simpler. We shall consider these various interrelations, in terms of increasing complexity, in the three media of land, sea, and air.

A. Land Transport

Devices—Roads. People who travel entirely on foot need little in the way of roads, and the trails which they follow are usually made by, rather than for, use. Thus there are large areas in the world which have no roads at all, or in which roads have been made only since the introduction of the automobile. People who use pack animals often have no vehicular roads, and the scarcity of roads permits the survival of packing in such mountainous countries as Tibet, Peru, and Albania, where vehicular road-making would be laborious. In such regions, horses, mules, llamas and other animals naturally follow zigzag courses with hairpin turns, climbing steadily at a constant grade; when people make roads, they usually follow these animal trails. However, trails of this kind have a tendency to be washed out in rains and to become impassable; some road-making is usually necessary to keep them open. In the Rif, for example, the men of a village go out after rains with their hoes to repair these places.

On treeless plains, and on drylands, where there is not too much sand, people can drive wagons or automobiles about without the need of roads, and encounter trouble only when it is necessary to cross a stream. In tropical forests, road-making is difficult because of the quick growth of the trees, and unless the road is paved or effectively maintained, it is soon grown over again. In temperate forests, this problem of regrowth is not important, but it is still necessary to cut down many trees, and in the more northerly parts, to keep the roads free of snow in winter. Before the introduction of the automobile, most people in the northern United States and Canada, and in northern Europe, put their wheeled vehicles up for the winter after the first heavy snowfall, and used pungs and sleighs. In the boreal forests, road-making is difficult and expensive, particularly because settlements are so scattered and because the land is often swampy; hence travel by water and air is more practical. In polar climates, road-making is out of the question.

Good paved roads are made only in regions of dense populations, or in regions which commercial peoples resident elsewhere wish to exploit. The Incas of Peru had a system of stone-paved roads running from one end of their empire to the other, and from the coast to the highlands; by means of these roads, they maintained their political power and exchanged the products of the different climatic regions. The Maya of Yucatan similarly built a number of paved roads between temple centers; although Yucatan is covered with tropical forest, it has no rivers and land transport was the only feasible method. In the Old World, the Babylonians and other Mesopotamians paved roads with bitumen, or petroleum resin; the Romans built a system of narrow, stone-paved roads over most of their empire, and they were able, like the Incas, to send soldiers out rapidly in case of trouble, and to move goods quickly from region to region. The Ottoman Turks, at the height of their expansion, followed the Roman example. In China, in contrast, roads have always been few, narrow, and poorly kept. There are several reasons for this. The various regions of China are largely self-sufficient in commodities, much of the travel goes by rivers and canals, and there are few beasts of burden or wheeled vehicles. Russia likewise lacks many good roads; this deficiency is a corollary of poverty, subsistence agriculture, and a scarcity of all kinds of machinery. In contrast to China and Russia, the modern American road system is the highest development yet attained. Because of the tremendous number of automobiles and the danger of accidents, many of the major highways are divided into two one-way sections, each of which may have as many as four lanes, with elaborate over and under passes. It is significant that in preparation for the Second World War, Germany built a similar set of highways.

Railroads, which need not be described here, were built before modern paved roads, as the steam engine was invented before the gasoline combustion engine. Many countries, opened up to travel only during the last twenty or thirty years, have excellent motor roads but no railways; this is true of many of the countries of Africa.

Devices—Fords and Bridges. Essential to effective roads are fords and bridges, particularly the latter. In simple civilizations, as a rule, people do not know how to make bridges more complex than a single log laid across a stream, and often they wade, use stepping stones, or cross in a canoe. In a number of regions, however, suspension bridges were made before the advent of the machine age; in New Guinea, Indonesia, Tibet, Peru, and Mexico. In all of these regions the people lived by agriculture and practiced a considerable trade; in none of them were wheeled vehicles commonly used. In most of these countries, the bridges are made of thick ropes of vegetable

fibers; the usual technique is to string three of these ropes across the gorge or stream, so that the middle one is lower than the other two, and then to connect them together with cross cords over the entire distance. The traveler then walks on the middle strand and holds on to the other two with his hands, using them for rails. In some cases, there are four ropes and the bottom two are connected by wooden slats. Suspension bridges of this kind sway and sag, frightening the unaccustomed traveler; they are, however, usually safe and relatively easy to build or repair.

Arched masonry bridges are confined to such regions as Europe, India, China, Japan, and the modern countries of the New World; they can be made only by people who use masonry in house building and who also know the principle of the arch. Furthermore, they are worth the effort of building only in countries where there is a large amount of traffic, particularly wheeled traffic, and where fording or ferrying would seriously impede communications and trade.

B. Water Transport

Ships, unlike land vehicles, do not require special tracks or trails. That is one of the great advantages of travel by sea. Simple or small craft also need little or nothing in the way of docking facilities; people who use rafts and canoes pull them up on the beach or the banks of streams when they disembark. Even the Greeks and the Phoenicians, and the Norsemen of the days of Leif Ericsson, did this. Large sailing ships, however, and steamships, must have docks. In order to make docks, many people on shore have to cut down trees and drive piles and build platforms on top. They also, as a rule, build warehouses on or near the docks, and construct roads to them so that land vehicles can be driven up to the sides of ships to receive the cargo. In other words, there must be a close coordination between sea transport and land transport. On shore, near the docks, there must be a large land population, including professional stevedores, to load and unload the ships; this is a specialized duty which ordinary seamen, in modern ships, are not required to perform. The most modern harbors, like Alexandria and Casablanca, have mechanical cranes running on tracks along the dock-edge and operated by a single man each; with such a crane at each hold, a large cargo ship can be unloaded and reloaded in a few hours.

Aside from docks, harbors which take ships of any size need in many cases to be dredged periodically, particularly if the harbors are located near the mouths of rivers which deposit silt. To dock-building, stevedoring, and harbor dredging may be added the services of tugboats and aids to navigation, such as channel-markers, bell-buoys, lighthouses, and lightships. It re-

quires the services of many individuals on land and sea to operate these devices and conveniences, and thus make modern shipping possible. Shipping has a bearing on the livelihood of everyone living in a modern state; our largest cities are built, in most cases, at points where land and sea transport lanes meet; our great processing plants are often located on waterways so that their products can be loaded directly onto ships. When a modern nation gets control of the sea, and blockades a land power, every individual in the land power feels the pinch, and the destinies of nations lie in the hands of those who control the sea.

Canals. A further relationship between techniques of water transport and those of land activities is found in the construction of canals, or artificial inland waterways. Canal digging is a laborious process which requires the labor of a great many individuals, and hence it is feasible only under special circumstances. One of these is the situation in China, where a large agricultural population lives on a fertile plain and keeps a minimum of domestic animals. In China, labor is cheap, land transport poor; for several millennia the Chinese have been constructing great inland waterways composed partly of river channels and partly of canals. In China, before the introduction of the railroad, most of the goods transported in the country went by river and canal boats. It was more economical to dig canals and to have the boats hauled by men walking along the banks than to devote agricultural land, which fed human beings, to the feeding of draught animals.

The second circumstance which makes canals feasible is a purely geographical one—to cut a ditch through a narrow isthmus and thus save ships a long sea voyage. The Panama Canal, the Suez Canal, the Cape Cod Canal, and the Kiel Canal are all waterways of this category. Such canals are not built by the people who live on the banks but by the people who will derive the most advantage from their use, no matter how far away their homes may be. The political as well as economic importance of such canals, especially the world's two greatest, at Suez and Panama, need not be emphasized.

C. Air Transport

It is also unnecessary to spend much time discussing the techniques by which people facilitate and regulate air transport; indeed, these techniques are not only well known to most Americans, but they are changing and being improved upon so rapidly that any elaborate discussion of them here might soon be as obsolete as last year's bombers. The airplane, like the surface ship, needs no roads. Like the ship, however, it needs ports and landing places. Like the ship, it can be operated most safely when channels and traffic lanes are well marked. In the case of air traffic, this is done by means of

electric markers along all principal air routes, the names of towns and small airports painted on the roofs of large buildings, flood lights around major airports at night, and, most important of all, the radio beam, which permits blind landings, and which is also used in ship navigation. The radio telephone itself, by means of which the crew of the airship keeps in touch with the ground crew, is also a primary safety device, as is the altimeter, which permits the pilot to keep his ship at the correct altitude level and minimizes the chance of collision.

Conclusion

The key to the progressive development of our complex modern world civilization lies in the field of transport; the barriers and limitations of environment have receded with its increasing approach to technical perfection. The techniques of transportation affect, directly or indirectly, many persons; in our modern civilization, every person is concerned with them in some sense. The techniques of transportation are directly dependent upon other techniques, such as animal husbandry and metallurgy, and as the per capita volume of transportation increases, so does the proportion of persons directly engaged in it, and so do the volume and complexity of its interrelation with other techniques.

III. TECHNOLOGY AND ENVIRONMENT

An essential part of the problem of the interrelation of techniques, which we have just discussed and illustrated by examples, is the further relation between technological systems and the environment. From what has already been said, it should be clear that this relationship is as important a factor in the determination of the various civilizations of the world as the relationship between the techniques themselves, since the whole purpose of the techniques is to utilize the environment. Since, furthermore, techniques are designed to fit the materials with which they deal, the techniques will, of course, vary from area to area. In our descriptions of the various techniques, we have already indicated environmental differences; our task now is to summarize this material in terms of the technological combinations specified earlier in this chapter. Map 3, pp. 228-229, indicates the geographical distribution, in the ethnographic present, of these combinations.

A. Chipped Flint Tools. As we have seen, people who use chipped flint tools acquire food only by hunting, fishing, and collecting; they have no domestic animals other than the dog, and no means of land transport better than walking. Those who live along shores where seafoods are abundant

have rafts and canoes in which they can travel short distances along indented shores and between neighboring islands.

People who live by this combination of techniques have survived until modern times in deserts, Mediterranean climates, grasslands, mid-latitude mixed forests, and tropical forests. They do not now live in boreal forests or tundras, although the evidence of archaeology tells us that they once did. In other words, flint-chipping food-gatherers have occupied every kind of environment in all parts of the world, at one time or another. This is interesting to note, since one of the most important differences in the behavior of human beings and other animals is that man is able to survive in all climates. The only other species that can do this is the dog, which man has taken with him. The reason why man can survive in all climates is that he alters his environment to suit his physiology, instead of altering his physiology to suit his environment, as is the case with animals, who thus become differentiated into numerous species. We now know, therefore, that this human versatility, this ability to exploit any environment other than that of a glacial ice cap, was acquired by people practicing the simplest known combination of techniques, which may be considered the fundamental human system of technology.

The areas which people still practicing this technological system have occupied in modern times are restricted, although some of them are found on every continent except Europe. The reasons why peoples practicing these techniques have survived until modern times in these particular places are not accidental; they are determined by geographical laws. In order to explain this, we must divide the areas of survival into two classes, those which are unsuited for exploitation by means of other techniques, and those which are spatially remote from the centers in which advanced civilizations developed. Some, of course, are both.

To illustrate the first principle: the Kalahari Desert is too poor an environment for agriculture or animal husbandry, and no important mineral deposits have been found on it. Only the Bushmen, with their all-environment technology, can survive it. Therefore some of them still live there.

To illustrate the second: the fertile Mediterranean lands of Southern Australia, as good from the standpoint of soil and rainfall as Algeria or Southern Italy, were occupied by Australian Blacks living by a chipped-flint and food-gathering technology until about 150 years ago, when the English came in and replaced them. The reason why they lasted as long as they did was that Australia is extremely remote from any seafaring nation, and it was only when the English had developed excellent sailing ships, so that they could reach Australia, and had also developed machine industries, so

that they needed both raw materials and markets, that Australia was colonized.

All of the good environments, suitable for exploitation by people using advanced techniques, have been taken away from the flint-chippers in modern times. If we were to draw an additional map, showing their present distribution, it would be limited to those environments, like the Kalahari, the dryest parts of the Australian deserts, and the fjorded shoreline of Southern Chile, the environmental resources of which cannot yet be more profitably exploited by any known combination of more advanced techniques than those which the present inhabitants practice.

B. Polished Stone, Food-Gathering, Advanced Transport. Polished stone axes and adzes are made for cutting down trees. There are two principal reasons why trees should be cut down—to clear the land for agriculture, and to provide material for making houses, boats, traction implements, and vehicles. It is to be expected, therefore, that people with these tools should be farmers where the climate is suitable, and that they should be food-gatherers with advanced means of transport where it is not. Both of these expectations are almost entirely true.

If we look at Map 3 again, we will see that the peoples who use polished stone tools and who are food-gatherers live in only a few environmental areas—the polar tundras of North America, the boreal forests of the same continent, and the Northwest Coast region, with the addition of the forested areas of the Plateau, in Washington and Oregon, and parts of the California coast. In the Old World, there are a few scattered tribes in this classification in the boreal forests and tundras of Siberia.

The same two principles which determined the survival in specific areas of peoples using chipped flint hold true with this technological combination as well. In the first place, regions such as the Eskimo country and the whole boreal forest area of North America, as well as much of the Northwest Coast, are unsuited for agriculture; in the second place, people who had more advanced techniques than they, had not, before the invention of modern transportation, reached those areas in which agriculture was possible. On the California coast, for example, people might have introduced maize from the Southwest. Maize, however, does not grow well in a Mediterranean climate without irrigation, since it needs summer, not winter, rains; in California, irrigation is only possible when there are many workmen and a widespread political control. Hence on the coast of California, no one practiced agriculture before the arrival of the Spaniards with their Mediterranean plants, which will grow without irrigation.

The only technique of food acquisition possible in boreal forests and

tundras, aside from hunting, fishing, and collecting, is reindeer breeding. In most of Siberia, reindeer breeders supplanted hunters and stream-fishermen, or combined techniques with them, some three to five hundred years ago, when our knowledge of these regions begins.

The use of polished stone implements by food-gatherers, therefore, is limited to the areas shown on the map by environment, both in the sense of climate and in the sense of barriers and distance.

It is to be noted that many of the secondary techniques which these people practice are more advanced than those practiced by the flint-chippers; all of the former make good houses, all of them make technically complicated traps, such as spring-poles and dead-falls, with mechanically advanced release mechanisms; all of them who need it have tailored clothing, and all have some advanced means of transport, including dog-drawn or man-drawn sleds in the boreal and polar regions, and good canoes in all regions.

It is not remarkable, therefore, that people using these techniques have supplanted flint-chippers, or else taught them new techniques, both in the cold parts of the world where dog-sleds are superior to foot-travel and tailored clothing is more comfortable than a robe and moccasin costume, and along forested shorelines where a large dugout or plank canoe is more seaworthy than a reed-bundle raft. The techniques in question have supplanted the flint-chipping techniques, however, only where no environmental barriers prevented their spread; that is why the Fuegians, who live in a cold climate with large trees, still use chipped flint only. As a matter of fact, at the time the Fuegians were first studied, the Chonos and the Alikaluf, who live to the north and west of them, had begun to make canoes out of planks split with stone axes, a technique learned from peoples to the north; just as some of the tribes had begun to make polished stone axes also at the time Australia was first settled. If the conquest of Tierra del Fuego and Australia could have been postponed a few centuries, some considerable changes might have taken place.

C. Polished Stone, Agriculture, Simple Transport. Archaeological evidence indicates that in all probability the first agriculturists everywhere used polished stone axes; farmers who still use these tools are to be found in regions where the use of metal has not yet spread (in the ethnographic present) from its centers of invention. Most of the agriculturists of the New World used these tools at the time of discovery; in the Old World, they were confined to Polynesia and Melanesia. None of the peoples who used this kind of tool in modern times knew the use of traction animals,[3]

[3] The dog, used in Arctic regions for traction, is generally used thus only on snow; exceptions to this are few and unimportant.

and hence none of them used the plow. It is doubtful if anyone ever has used the plow who did not also use metal, since traction animals, other than those used only for work in snow, seem to occur only with metal.

Whatever the reason for this, all farmers who use polished stone tools farm by hand, and have no efficient means of land transport. With their cutting tools, however, they can make good, seaworthy ships, as well as river craft, and only those farmers who lived away from navigable waters, therefore, lacked advanced methods of transportation. The basic difference between the technology under consideration and that to be taken up in the next section is the presence or absence of water travel.

Farmers with polished stone tools occupy every type of environment in which any kind of agriculture is possible. The techniques which they practice, which are all hand techniques, are relatively laborious, and in forested regions, they all use the slash-and-burn method, which has been fully described elsewhere. In deserts, as for example in the Pueblo region of the American Southwest, they have developed intensive methods of dry farming in arroyo beds and seepage fields.[4] In grasslands, as among the Mandans and Arikara of the Dakotas, they cultivate only the flood plains of the rivers. In all of these areas, they utilize the landscape more efficiently, i.e., are able to support more individuals per square mile, than food-gatherers could in the identical areas, but they cannot live in some of the regions which the food-gatherers occupy; their geographical range is limited by deadlines of moisture and temperature, as well as by the encroachment of people practicing techniques superior to their own.

D. Polished Stone, Agriculture, Advanced Transport. Farmers practicing the techniques discussed above make and use serviceable canoes wherever suitable trees are available. In most forested regions, as in the Mississippi valley, and in the Orinoco-Amazon drainage system, the great majority of the agricultural population, if not all of it, lived on the banks of navigable streams where they cultivated their fields. In Polynesia and Melanesia, most of the population was concentrated on the coastal reaches of the islands; only in New Guinea and the larger islands, such as Bougainville, New Britain, and Viti Levu (Fiji), were there inland villages whose inhabitants had no means of navigation.

In Melanesia, there is a marked difference in wealth and hence in technological status between inland peoples and those living on the coast; this is due not only to the fact that the coastal peoples can catch fish in lagoons

[4] See exposition of Hack's material in Chapter 7, and also techniques of irrigation, as among the Pima and Papago of Arizona.

and off reefs, but also because they have good sailing ships, with which they make trading voyages from island to island.

E. Metal Tools, Food-Gathering, Simple Transport. This combination of techniques is an extremely rare one, and is found only in one environment, tropical forests. The people who practice it include the African pygmies, the Semang and Sakai of the Malay Peninsula, the Vedda of Ceylon, the Punans of Borneo, and a few others in the Indonesian area.

All of these people obtain metal cutting tools by trade; none know how to smelt or forge. All of them live inland from the coast, so that they have no opportunity to make boats with their cutting tools. What is most important from the standpoint of determining their total adjustment, all of them gather forest products and trade them with more advanced peoples, who in turn give them their iron cutting tools and cloth for breech-clouts, as well, in some cases, as cultivated foods such as plantains and rice.

Because they do not have to spend time making cutting tools, and because they can hunt, gather camphor, gutta-percha, etc., efficiently with metal tools or weapons made with metal, these people are able to accumulate surpluses of negotiable commodities which they can easily trade. They are thus able to exploit the tropical forest environment in the highlands and away from the rivers where the slash-and-burn people cannot easily penetrate. They lead lives of exaggerated simplicity because of their isolation, specialization, and opportunities for trade.

F. Metal Tools, Food-Gathering, Advanced Transportation. People with metal tools and good transportation who are food-gatherers live only in regions where some special environmental circumstance makes this profitable. Such circumstances occur in three environments only: deserts, boreal forests, and grasslands.

In the North Arabian Desert, for example, there is a tribe, or class, of people known as Sloubbies, who use firearms which they obtain by trade, ride on donkeys, and hunt gazelles. This is not, however, the sum total of their activities, for they trade meat, skins, and ostrich plumes to the pastoralists in return for some vegetable food and milk, and for metal tools, guns and cloth; they also mend copper utensils and make simple wooden objects, such as well-pulleys and saddle frames, for sale. Like the tropical forest food-gatherers discussed in the last section, they do not form an economically independent group at all, but exploit a special environment, and a particularly difficult one, for technologically more advanced peoples.

The same is true in the boreal forests. The old-time French Canadian and Indian trappers, before the days when mink and fox farms and airplane transport made their business precarious, used to make a good living

by going up the rivers in canoes in the late summer, trapping all winter, and canoeing down to a trading post again the next June, with a large load of valuable furs. A single family of Montagnais Indians living in this way used to get as much as four or five thousand dollars a season for their furs at the Hudson's Bay post at Pointe Bleue, Lake St. John. From the standpoint of classification, however, they were only partly food-gatherers, since they carried up with them as much flour, lard, and sugar as their canoes could hold, and their diet consisted of a combination of these commodities, moose meat, fish, and berries. With firearms and steel traps, furthermore, their hunting and trapping techniques took less time than was the case with their ancestors who used bows and arrows and dead-falls.

A group of people who live in the same type of environment and who are more truly food-gatherers are the Ostiaks of the Obi River country in Siberia; they fish along the streams in the summertime and hunt in the winter, using canoes in summer and either dogs or reindeer with sledges in winter. Those of them who keep reindeer do so for traction; they do not breed them expressly for food. The Ostiaks obtain, by this manner of adjustment to their environment, enough furs besides those needed for clothing so that they can obtain by trade metal tools and other imported objects such as tobacco and vodka.

There have been several grasslands peoples in the world who had metal tools and superior transportation, and who were nevertheless hunters. This is an unusual combination, and one which nowhere lasted very long. It occurred on the American Great Plains, and on the Argentine Pampas, and in Patagonia; in both the United States and the Argentine, it lasted as a flourishing system no more than one hundred years.

What happened was this. In both areas Indians obtained horses and iron tools from the white men, through indirect trade. In both areas they developed highly efficient hunting techniques which enabled them to travel long distances for game, and to live in large communities. In both areas, superior weapons and superior transportation also led to intense rivalry and warfare between different camps and bands of Indians who came out onto the grasslands from other environments to exploit the animal resources with this new set of techniques. In both areas, the white man arrived soon afterward with even better techniques, including plow agriculture and such animals as cattle and sheep, killed off the Indians' source of food, and after a brisk and hard-fought period of warfare, displaced the Indians.

The story of the adaptation of the Plains Indians and of the Puelche and Tehuelche of Patagonia to their environment in terms of new techniques is one of the world's most striking examples of historical change due

to the introduction of a new technique. Our purpose in bringing it up here is merely to show that the combination of techniques dealt with in this section is an unusual one in the grasslands environment and one which depends, like all other combinations of metal, food-gathering, and good transportation, on trade relations between people practicing different techniques and living in different environments.

G. Metal Tools, Agriculture, Simple Transportation. This combination of techniques is limited to one continent, Africa, where it is very common, and, in fact, characteristic of the whole tropical forest, excluding the pygmy country, and much of the scrub-forest grasslands area south of the Sahara.

The unusual feature of this combination is the lack of advanced transportation. There are several reasons for this, as follows. In the tropical forests, large animals suitable for traction and packing cannot live, or, at least, cattle, horses, asses, and camels, the four used in other parts of Africa, will not prosper there. In much of the scrub-forest area, the tse-tse fly also makes it impossible to keep these animals. Out on the grasslands, however, there are many tribes, such as the Nuer in the Sudan, and the Zulu in South Africa, who live by a combination of cattle-herding and slash-and-burn agriculture. These people have iron tools with which to make plows, cattle to draw them, and seeds to plant in the fields thus prepared.

None of these people hitched their cattle to plows, and none of them used them to pack burdens or draw vehicles. One reason for this failure to combine the available techniques is that by practicing slash-and-burn agriculture in this environment they cannot produce more vegetable food than they need for their own consumption; hence they could not feed their animals on grain or hay, but were obliged to pasture them away from the agricultural settlements. Another is that in grasslands, primitive plows are not effective; these people were not sufficiently advanced technologically to make the deep, iron-shared plows which they would have needed.

H. Metal Tools, Agriculture, Advanced Transportation. This is the combination of techniques out of which the truly complex and elaborate civilizations of the world have arisen. It is found in all environments in which any kind of agriculture is possible—all environments, in other words, except boreal forests and polar tundras, and it was separately developed and spread in both the Old World and the New.

In the New World, the Indians of Peru and Bolivia developed this kind of agriculture and practiced it both on the highlands and along the Pacific coastal plain. They commonly used bronze tools for wood cutting and for general handicraft; they had llamas to carry goods overland, and sailing rafts to carry them on Lake Titicaca and along the shore by sea.

As we have already seen, farmers who use hand techniques can get as much out of the soil in certain environments as those who have animal traction, although much more labor is involved. The Peruvian Indians, although they had llamas to furnish transport, wool, meat, and dung for fuel, did not use them for traction. They were able, however, to exploit their particular environment to a degree unknown elsewhere in the New World on account of a particular combination of circumstances; i.e., intensive agriculture was possible in this environment without animal-drawn agricultural machinery, and they also had an adequate means of animal transport. With this combination, they were able to develop a civilization of high technical complexity, and the only true empire known in the New World. They were able to build and live in the New World's only really large cities, which were comparable to the early urban centers of Egypt, Mesopotamia, and India, which also flourished in an age of bronze. There was, however, one essential difference between their civilization and that of those urban centers of the Old World; the Inca had the llama as their animal of transport, the Old World peoples had the ox, the ass, and horse. The llama could not be taken out of his environment, and the Inca technique of agriculture could not be as efficient if introduced elsewhere. The ox, ass, horse, and the plow and wagon, could be introduced profitably in many environments. The Inca technology remained a local one, the Old World system spread into many environments and all continents.

Although it is the means of transport that makes the difference between a simple and a complex adjustment in the Inca area, in some environments the deciding factor is really traction. In Indonesia, for example, the farmers are able to cultivate almost every square foot of soil by means of water buffalo and wet rice; hence Java and the rice country in the Philippines are among the most densely populated areas of the world. In precisely similar regions in near-by islands, people who do not possess buffalo or wet rice still use the slash-and-burn system and live in scattered communities. That it is not simply wet rice, rather than traction, that is essential here can be shown by the example of Northern China. Here the cereal is wheat, which farmers cultivate with the plow and transport by human porterage and by water.

I. Metal Tools, Animal Husbandry, No Transportation. This combination is, needless to say, a rare one, since people who live by means of animal husbandry usually have a means of transportation in their animals. However, there are some exceptions to this rule, and all of them occur on grasslands, which is the environment most suited to most forms of animal husbandry. One example is that of the Toda, a well-known tribe of dairymen

living in the Nilgiri Hills of Southern India. The Toda keep water buffalo, which they milk. From the milk, they make ghi, which they sell to agricultural people who live near by, and in return receive iron goods, textiles, vegetable foods, and almost everything else that they need except milk and milk products. They need no advanced technique of transportation, because the villages with which they trade products are not far away, and the commodities which they need to carry are not bulky. Their animals are kept for one purpose only, to produce milk, and, as in East Africa, they are not used for other purposes except to furnish meat at rare occasions, usually after they have died.

In East Africa, there are some tribes, including the Masai, who keep cattle for milk and blood, and who like the Toda obtain their vegetable food from outside. Such tribes always have some kind of relationship with agricultural tribes by means of which they may obtain their tools, vegetable food, and other necessities; in the Sudan, the Fula have built up an elaborate caste system in which they, as cattle-herders, occupy the highest niche. These tribes, including the Fula and Masai, are warlike and can enforce their superior position on the relatively immobile farmers.

J. Metal Tools, Animal Husbandry, Advanced Transportation. This is the combination of techniques which has produced the great pastoral nomadic civilizations of the world, including those of the Mongol Empire and the Arabian Bedouin. It is limited to three environments—deserts, grasslands, and boreal forests, and to the Old World, in which animals suitable for this type of adjustment were available for domestication. The close relationship between these environments and the techniques employed can be easily illustrated. For example, in the North Arabian desert, the species of animals herded closely reflect the degree of aridity of the landscape.

Out in the driest part of the desert, where annual herbs are uncertain and the only sure feed is perennial bushes, the Bedouin breed only camels, because only camels can live off this landscape, and can move rapidly enough between water-holes and pasture. Even camels, however, must be brought to the desert border during the three hottest and driest months of the year. Around the edges of the desert, where the annual herbs are more dependable, other pastoralists herd sheep with a few camels, and on the borders of the agricultural country, part-time farmers bring their sheep out from their villages to feed during the season when the cereal crops are growing. The Bedouin keep horses, but they feed and water them by hand, since they need them for rapid transport in warfare.

The Bedouin need metal not only for cutting tools and weapons but also for well-digging implements, and for containers. The kettles in which

they boil their food are of metal, as are their food dishes, bread-baking pans, and coffee mortars. Every article which they possess, from their tents to their water-skins, must be easily packed and portable. Every technique which they practice must be of such a nature that the equipment can be carried around and the process followed anywhere. Thus the smiths who accompany the Bedouin encampments cannot have heavy anvils or permanent furnaces; the women must grind their wheat in small hand querns, since any device which utilized animal power for grinding would be too cumbersome. The limitations of the drylands environment prevent the possession of elaborate machinery at this technological level.

In the grasslands occupied by pastoral nomads, the greater amount of rainfall permits the herdsmen to graze cattle and sheep; the better the land, the more suited for cattle, while sheep can be grazed on land that cattle have passed over. Horses, furthermore, can be grazed on land that supports cattle and sheep, and do not need to be hand-fed on imported food, as in Arabia. The optimum grasslands area of the world, the one in which pastoralism has been developed to its greatest extent, is, as might be expected, the largest such area lying in temperate latitudes—the plains region extending from southern Russia to China, with a few interruptions by mountains and deserts.

This great grassland is smooth enough, over most of its surface, to permit the passage of wheeled vehicles without roads. With wheeled vehicles the Central Asiatic pastoralist can possess and transport larger and heavier objects than the Arabian Bedouin; in the days of Genghis Khan, important Mongols lived in domed yurts, thirty feet wide, built permanently on wheels. With horses to ride and wagons to carry goods, it is not remarkable that the iron-using pastoralists of this region have been able to wield strong political power from the days of the Scythians up to the era of the railroad and automobile.

Animal husbandry in boreal forests has developed around one animal that can be effectively bred in this climate, aside from the dog. Since the reindeer furnishes meat, milk, skins, and transport, since hunters like the Tungus, who are mounted on reindeer, can obtain a large surplus of furs in a winter by virtue of having reindeer milk to drink and reindeer backs to ride on, reindeer-breeding is the most efficient food-producing technique yet devised in the boreal forest regions and it has progressively tended to supplant all others.

Before leaving this subject of animal husbandry with effective transport, there is one point which should be made clear: all peoples who practice animal husbandry as a principal means of livelihood are dependent upon either

agriculturalists or hunters for part of their food supply and for other exchange products. Thus the Arabian Bedouin get wheat from the farmers on the edge of the desert, the Kirghiz herdsmen have relatives who grow millet in the winter pasture lands, and obtain other cereals from traders; and the Chukchi in Siberia trade reindeer skin and meat with their maritime relatives who live on the tundra on the shores of Bering Strait for walrus and seal fats, which are carbohydrates.

There is only one exception to this rule, that of the Hottentots of South Africa, who lived in a grassland region with cattle, and who collected wild vegetable food like the Bushmen. They did this because they had no agriculturalists with whom to trade, having historically come down from the north, and because they were isolated and surrounded by Bushmen. This lack of adequate vegetable food in quantities to balance their animal foods placed them in a distinctly inferior position and prevented their expansion.

IV. THE INTERRELATION OF ENVIRONMENTS IN TERMS OF TECHNIQUES

We have now surveyed the technological adaptations which people make at various levels of technical skill to the several environments of the earth. We have seen that the simplest known technology, that of food-gathering with the use of chipped flint cutting tools only, is advanced enough to give man the power of survival in any environment. We have also seen that the technologies based on husbandry are more limited in scope; that there are environments in which these systems cannot be practiced. Thus there is one world technology, which is the simplest of all, and a number of local technologies which are more complex and in most regions more productive. It would seem, therefore, that as technological systems become more efficient they also become more specialized and more dependent upon specific types of environment.

This is true, however, up to a certain point, beyond which the possibility of a world technology opens up again. The agency which opens it is the factor of transportation. This can be easily illustrated. The Bedouin of Northern Arabia raise camels, but they eat a diet consisting of wheat and camel milk. The farmers of Syria and Iraq raise the wheat. Thus the two environments, a desert and a Mediterranean-oasis type, are interrelated since the people who live in them exchange products. They do this because the Bedouin have good animal-power transportation.

Let us take another illustration. A student eating breakfast in Cambridge, Massachusetts, consumes, let us say, orange juice, a dry cereal, milk and cream, coffee, toast and bacon. These materials come from Florida,

South Dakota, Vermont, Brazil, and Massachusetts. With his coffee, he smokes a cigarette containing tobacco from Kentucky and Turkey, rolled in paper made from Canadian pulpwood. By the simple, everyday actions listed above, he is utilizing five different types of environment. Before the day is out, he will probably have made use of all types, and of materials from all continents and many islands. He does not merely use two neighboring environments, like the Bedouin, and the difference lies in the fact that he and his people make use of machinery driven by sources of natural power, including water power, the expansion of gases, and electricity, in acquiring, processing, and transporting materials, while the Bedouin use only hand and animal power.

One may, therefore, demonstrate a relationship between the source of power used and the amount to which people utilize exotic environments. At the bottom of the scale fall the people who use hand power only, whether they be food-gatherers or farmers, or, rarely, animal breeders; in the middle of the scale are those people who use animal power, like the Bedouin, the Lapps, and others, or those who use ships and waterways, like the Chinese, or who use both, like the Europeans of the period before the industrial revolution. At the top of the scale are the people who participate in the modern world civilization of natural power.

There are some people using hand power alone who are able to utilize several environments; the Aztecs of the pre-Conquest days are an example. They lived on a grassy plateau, and traded with tropical forest people. Their traders traveled on foot, and porters carried their goods. Here the landscape was at its optimum for hand-tillage, and the distances between environmental areas, owing to differences in altitude, were not great. Despite this, they utilized two neighboring environments only.

In most environments, the maximum amount of food which can be obtained from the landscape by the use of power-driven machines can also be obtained by either hand labor or a combination of hand labor and animal power. The introduction of power-driven machinery has not increased the productivity of the landscape per acre, but it has greatly decreased the amount of human labor needed to exploit it. For example, the Chinese farmers of Manchuria can grow as much wheat per acre as the American farmers in Dakota, if not more, but it takes many times more men per acre per hour in Manchuria than in Dakota, to grow it.

In inhospitable environments, where only food-gatherers can survive by their own devices alone, the introduction of firearms and power-driven machinery only depletes or exterminates the game and renders the environment less habitable than before. There is one thing which power-driven

machinery permits, however, in such inhospitable environments—that is, the maximum extraction of inedible materials to be used elsewhere. For example, in the boreal forests of Canada live many men, who cut down pulpwood, who work in asbestos mines, who trap fur-bearing animals, and who prospect for gold. Nevada, which is probably the least productive state in America from the standpoint of natural foods or husbandry, is one of the richest in minerals, and a considerable population lives there, extracting minerals. Both the men who work in the Canadian woods and the miners of Nevada obtain their food from more productive environments. On this basis, a landscape poor in food but rich in inedible products may support many times as many people as it could if they had to derive their food from it. Since farmers who use power-driven machinery work so efficiently, from the standpoint of time vs. production, they release many others from the necessity of food acquisition to the tasks of extracting inedibles from all environments, to work in factories, to become administrators, preachers, professional men, and even to form a leisure class.

Thus there are two kinds of people who can use any and all environments; the simple, hand-power people, who cut with chipped flint tools and hunt, fish, and collect their foods from their immediate landscapes, and the members of the modern world technology, who can go anywhere and carry their food with them. The great difference between them, from the standpoint of the rise of human civilization, is not the techniques that they use, but the fact that in the first place only a few individuals know and interact with each other, while in the world civilization many individuals know each other, travel widely and interact directly, while everyone in the world has some kind of relations with everyone else, either indirect or direct. The techniques have made this result possible; now that we have studied the techniques, we shall concern ourselves with their results on the lives of individuals.

SUMMARY

The totality of techniques which any people employs in their particular environment for the purpose of adapting themselves to the landscape is known as their *technology*. The different techniques of which a technology is composed are all interrelated, since they are practiced by the same people or by people dependent on or interacting with one another. For example, people who use animals to provide power in one technique will use them in others. The same principle is true in regard to other sources of power, kinds of implements, and methods of interaction, as with metal tools, the assembly line, etc.

There are three key factors on which the technology of a people depends: (1) the kinds of cutting tools used, (2) the methods of obtaining food, and (3) the methods of transportation. Technologies can be defined on the basis of combinations of these three variables at various levels of complexity, and these levels reflect different degrees in the ability of people to amass surpluses, develop specialization, and attain complexity in interaction, all in terms of the several environments.

The simplest type of technology so defined is that of the peoples who use only chipped flint or comparable cutting tools. These people are all food-gatherers and have no advanced techniques of transport. They can derive a living from the immediate environment in almost any environment. The most complex type is our own world technology, with complex and varied metal tools, all kinds of techniques of obtaining materials, such as agriculture, animal husbandry, sea-fishing, mining, etc., by means of power machinery where it is advantageous, great individual and regional specialization in techniques and products, and power-operated methods of transport by land and sea, and also by air.

We too can live in all environments, not by exploiting single landscapes separately, but by pooling and redistributing the products of all types of environment. Between these two extremes lie the other technologies of intermediate complexity, adapted to single landscapes or combinations of them.

CHAPTER 11

The Division of Labor—Technology and Human Relations

INTRODUCTION

As we have seen in the last chapter, different peoples adjust themselves to their environments by practicing different combinations of interrelated techniques. Certain of these combinations enable people to live simply, taking little from their environments except wild plants and animals for food, and a few minerals which lie near the surface of the ground. They build no imposing edifices, make no roads, and alter their landscapes so little that hardly a trace remains of them after they have gone. Other people alter the landscape profoundly, cutting down trees until no trace of the original forest cover remains. They kill off the game and introduce new animals and plants; they terrace the sides of mountains, divert streams from their courses; they build a complex web of paved roads with over and under passes and bridges, and quarry whole hillsides of stone which they carry from one climatic region to another, and the enormous cities which they erect completely mask the original appearance of the earth's surface.

In the preceding chapters of Part II we have described the various basic techniques of acquiring, processing, and transporting materials in terms of the four factors: implements, forces, actions and interactions. We have already shown how important the factor of *forces used* is in the development of complexity in technologies. The fourth factor, *interaction,* is equally important, if not more so; the coordination needed in any complex technique is impossible without interaction. As we have seen, most complex techniques involve the activities of more than one person, and, in fact, where people practice a number of complex techniques, extensive interactions must take place to coordinate the work of manufacturing, to secure raw materials, and to exchange the goods produced. In other words, the growth of complexity in technical processes goes hand in hand with an increase in the amount of interaction and in the complexity of the interaction pattern. Thus the utili-

zation of natural forces upon which complex techniques depend provides the basis for the development of complex human institutions.

What we intend to do at this point is to study the techniques which we have already described in terms of the amount and variety of interaction which they need for their completion, in order to show (a) that the techniques which comprise a technological system are just as closely interrelated in these terms as they are in terms of basic tools, materials, implements, and forces; (b) that there is a definite progression in the complexity of human societies or civilizations on this basis; and (c) that this progression closely follows the degree of complexity in the purely material aspects of the techniques used in these societies, since the deciding factor between simple and complex techniques lies in the degree of specialization, or in the division of labor. This is a form of adjustment between individuals. The greater the complexity of the adjustment, the more complex the civilization.

I. THE DIVISION OF LABOR

Some techniques which people practice require comparatively little skill. For example, anyone can easily learn to weave a basket, skin a deer, or ride a donkey. Any one person can learn to perform all three of these actions, and others as well; he does not need to specialize. But the making of a wheel-turned vase, tanning a hide, or driving a railroad engine are actions which require much more skill and a comparatively long period of training. In order to perform any of these techniques a certain amount of specialization is necessary; expert potters are seldom master-tanners or railroad engineers as well. The average individual can absorb only a certain amount of training, and can attain a high degree of skill at only a few techniques. If he is to do any one thing well, he must be a specialist, or he will be a "Jack of all trades, and master of none."

In some societies, as we have seen, there are no specialists, since all techniques are simple; in other societies, there are many specialists because of the complexity of the techniques. In our own society almost everyone is a specialist of some sort. Now a specialist can produce more goods or perform more services per unit of time spent than a non-specialist, particularly in the more complex techniques. Hence the amount of goods produced and services rendered per capita by any group will vary largely in proportion to the number of specialists among them; the complexity of techniques used will vary similarly.

This does not mean that in a society of specialists, everyone performs elaborate techniques; on the contrary, many individuals may perform extremely simple actions, which are actually parts of a total technique of great

complexity. For example, no one man in a factory builds an automobile; instead, one man, like Charlie Chaplin in "Modern Times," may turn a certain nut on an assembly line over and over all day long, every day, as the half-assembled vehicles are carried past him. The automobile is the completed product of several thousands of separate actions performed by different men. The vital factor in the automobile-making technique is the *timed interaction* of many men under skilled leadership and direction.

The Division of Labor on the Basis of Age. All human beings, all social groups, have some kind of a division of labor. There are two forms which this takes among all peoples: the age division and the sex division. The age division is universal, because, as we have seen in Chapter 3, the human infant is unable to take care of itself at birth, and, in fact, matures so slowly during a long conditioning period that it is usually dependent upon its parents for food, shelter, and the other necessities until the age of puberty or later. The activities of a child, therefore, differ from those of an adult in the prime of life. The adult's activities again differ from those of an old man or old woman who has lost his or her earlier muscular vigor, and whose faculties of sensory perception and of coordination may have been impaired by senile decay. All peoples recognize these three stages in the human age progression, and all of them make some provision for each group to have suitable tasks.

The Division of Labor on the Basis of Sex. The sex division is also universal, for the equally biological reason that the women are the ones to bear children and nurse them. As we have pointed out in the chapter on food-gathering techniques, men usually perform the tasks which will take them away from home all day or for several days at a time, while women usually perform those which can or must be done in the camp or house, or will take them away for only a few hours at a time, or can be done while they are accompanied by young children. Men perform tasks which require rapid motion, silence, and skill; women are ordinarily unable to perform such tasks because of the hindering presence of their children. Thus the household tasks fall to their lot, and the number of these tasks prevents them as a rule from becoming full-time specialists in any one technique. Furthermore, the materials or goods which they acquire or produce by their techniques are usually limited in quantity by the simplicity of the techniques and the fact that they cannot practice any one of them very long at a time. They only take care of home consumption and occasionally have a small surplus. In some societies, women sell their surplus eggs, handmade pottery, vegetables, and the like in markets, but the volume of trade in such cases is usually small.

The True Division of Labor. When we come to the *true division of labor,* in which different individuals of a society specialize in different techniques, we find that the specialists are almost always men, because ordinarily only men are able to devote all their working time to a single task without interruption, being free of household duties and the care of young children.

Since he can devote all his time to performing one technique, the specialist acquires more skill than the non-specialist and is more likely to invent or devise improvements than the non-specialist. Thus in a society of specialists the rate of technological advance will be more rapid than in a society of non-specialists.

In the case of the true division of labor, it should be made clear that individuals of the same sex and age groups differ from each other in the amount of time which each one spends at the various tasks which they perform collectively. For example, in early New England, eighty or one hundred years ago, three farmers lived on adjoining homesteads. All three grew mixed crops in the summer; in the early winter, however, the first farmer spent most of his working time on the lake, employed by an ice company to cut ice and pack it in the ice-house, whence it would later be shipped to the city; in late winter he collected the sap from his sugar-maple trees and made syrup and sugar for sale. The second farmer sat out in a little shop near the barn all winter, making shoes by hand from leather sent him by the shoe company, which collected the finished product. The third farmer cut wood in the forest behind the village and hauled it to the lumber mill in his pung.

All three of these men were part-time specialists, because they spent different amounts of time at specific techniques; one spent several months at ice-cutting, the others spent no time at all at this; and so on. None of them were full-time specialists, as all practiced farming too. The partial specialization of these men took a seasonal form, responding to the seasonal changes in the environment. If none of these men had been specialists, all three would have followed the same seasonal round; on the other hand, if the men had become full-time specialists, like factory workers, the seasonal changes which stimulated the initial step toward specialization would then have come to make little or no difference to them.

Degrees of Specialization. We may recognize three general stages in the development of the true division of labor, as follows:

1. None. There are no specialists; each individual spends his time performing most or all of the techniques which the other members of his sex and age group perform at any given time of the year. A family or other

single unit of individuals which includes members of both sexes and all of the principal age groups (children, adults, seniles) perform between them all of the techniques needed to maintain life at a subsistence level, and as a result of these activities, obtain directly from the environment all of the materials which they use.

2. Part-time. The individual spends part of his time performing some specialized technique by means of which he produces a surplus for exchange, or he works part-time at some special technique for hire. He divides the rest of his time between a number of techniques by means of which he provides himself and his dependents with some or most of the necessities of life.

3. Full-time. The individual is a full-time specialist. He engages in one technique only, be it fishing, cutting down trees, manufacturing shoes, or whatever. He trades all of his products, or all except the amount used by his family, for the necessities and luxuries of life. Some specialists live in the midst of populations where the majority of individuals are only partly specialized and which can, therefore, support but few men working at full-time techniques; others live in populations of specialists. An example of the first class is the village blacksmith in Africa, who lives among non-specialist farmers and forges their weapons and tools in return for the necessities of life; an example of the second is the average American, whether he works in a factory, or on a dairy farm or cattle ranch, etc.

Specialization and the Segmentation of Techniques. There is a second distinction between specialists, namely, that between those who perform one part only of a complete technique, and those who carry an entire process through by their own activities. The first type of specialist is by far the commoner. For example, in metallurgy, a single specialist seldom both smelts the ore and also forges it or casts it into tools. This happens sometimes in Africa, but, as a rule, one man or a group of men smelt the ore near the deposit, while others forge the ingots or blocks into implements. The man who does the forging may live hundreds of miles from the men who do the smelting. In Homeric Greece, there were no smelters; all of the metal was imported by sea; all metallurgists confined their activities to melting and casting it. They did not even know where the raw metal came from. Similarly, the sheet metal worker in an American factory may not know where his tools come from, or who rolled out the metal sheets which he fashions into boilers, mudguards, or whatever he is making. The worker in a shoe factory is little concerned with the source of the skins, or the identity of the men who have tanned the leather.

As a rule, therefore, the full-time specialist performs only a part of a technique. The Riffian woman who makes pottery for the market usually

digs the clay herself and performs the whole process of sifting, tempering, modeling, decorating, and firing alone. She is not a full-time specialist, for she also has other duties to perform during the working day. The city Arab in Fez, who makes pottery, does not dig his own clay; moreover, within his factory, there are men who sift and knead it, others who turn the vessels on wheels, others who paint them, and still others who fire them in the kiln. All of them are full-time specialists who work at the same task every day except Fridays (the Moslem sabbath) from morning until night.

As the number of specialists in a population increases, so does the segmentation of techniques likewise increase. Just as a full-time specialist can turn out better goods and more complex machinery than a part-time worker, so can a specialist within a specialty help in producing more goods per hour than a man who carries out the entire process himself, since by conditioning himself to a single motion or set of motions he can acquire greater dexterity and greater speed.

At the level of super-specialization more people produce *staples,* such as flour, sawed lumber, and sheets of cloth, than is the case at any lower level of technical complexity. Furthermore, whether the workers perform their tasks in sight of each other or whether they work in different regions or even in different environments, they must perform their interrelated tasks in concert, so that each man or group of men will produce the proper number of each kind of goods at the proper time; otherwise "bottlenecks" occur. As technological adjustments become increasingly complex, it becomes increasingly difficult for all of the men who work at interrelated techniques to adjust their activities to each other. Thus the silver miners may overproduce, and many of them will be thrown out of work; the coal miners may produce more coal than the smelters and metal workers need. On the other hand, there may be a deficiency in the production of machine tools and the men who use the tools to make airplanes and trucks may be idle waiting for the toolmakers to catch up with them.

In a relatively simple technological adjustment, therefore, in which there is a division of labor, each specialist produces independently his separate type of goods, and his amount of activity depends upon his relations with a small number of clients whose needs are simple and relatively constant; in a complex system of adjustment all techniques are in some degree dependent on all others and the task of organizing the interrelation of techniques is an extremely complex one; a technician may be thrown out of work not because there is no demand for the product which he helps ultimately to furnish, but because there may be a lag or deficiency in the performance of some related technique. In other words, the complexity of the interaction between

specialists, either directly or indirectly, increases as a function of the technical complexity of the processes involved, and of the ratio of specialists to the total population. The difference between simple and complex techniques is a question of the relative amount of interaction between workers rather than of the difficulty of the operations which each individual performs. In fact, in a complex technique, each individual may perform simpler operations than in a simple technique. A man who sees a piece of ore through the furnace and forges it into a sword has to be a more versatile craftsman than a punch press operator stamping out metal parts in an automobile factory.

II. TRADE

In a population containing few or no specialists, there will be little trade or exchange between individuals or groups of individuals, since each family, or band of families living together as a unit, produces all or almost all of the food, implements and clothing that the individual members of the group need. Each man is jack-of-all-trades; he is a tool-maker, hunter, house-builder, wood-worker, and everything else that a man can be with the techniques and materials at his disposal in his environment.

In every environmental area, however, some of the materials which people need are more commonly found, or are easier to obtain in some particular places than in others. For example, in the Eskimo country, there is only one good outcrop of soapstone suitable for lamps, in over a thousand miles of coastline. In Tierra del Fuego, good beech trees providing bark suitable for canoes grow along only one section of the shore. In New Guinea, close-grained stone suitable for polished axes is found in a few places only, and in Australia, straight saplings of extremely hard wood, suitable for spears, grow in certain parts of the country only.

The Eskimo travel with their dog sleds hundreds of miles to quarry the soapstone and make the lamps which are needed by every family; the Fuegians, who have good canoes and can travel easily by sea, come to the place where the large beeches grow and strip enough bark for their purposes; and in each case the people in the neighborhood do not molest the visitors because there is enough for everyone. The natives of New Guinea who live near the stone supply, however, quarry it themselves, grind out axes and trade them to natives of other regions, and the Australians trade their spears for shields made of soft wood grown in another part of the country.

From these examples we can see that at the simpler levels of adjustment, people circumvent the spotty environmental distribution of materials

by going to the source of supply, or by trading. Most peoples on a simple level of adjustment do both.

For our present purposes it is the second alternative, trade, which is important, since it is directly concerned with the division of labor and with the relative complexity of civilizations, while in the case of going to a place for a special object or material, there is no division of labor, since everyone does the same thing. Before we proceed, however, it will be well to make it clear what we mean by trade, and that can be done by contrasting it with the practice known as *sharing,* one type of which we have already illustrated.

Sharing. In a South African Bushman camp, shortly before nightfall, a hunter brings in the carcass of an antelope. He sets this down under a tree in the middle of the camp circle. Other hunters come back from their day's expedition, but it so happens that only one of these latter has been successful. He sets his animal down with the other. The chief then goes to the tree and cuts the carcasses of the two animals up into a number of pieces of meat. He then gives these pieces to the different families in the camp, so that everyone can eat meat that evening. In this way all of the people living together in that camp can be reasonably sure of food each day, no matter who is lucky one day and who the next, and in this way none of the food will be wasted or spoiled.

This practice of sharing is found among people who ordinarily have little food, and no way of preserving it; who, at infrequent intervals, find themselves with more than can be eaten before it will spoil. Where the food supply is both constant and abundant, or where there is a surplus and people know how to preserve it, there is no need for sharing outside the immediate family circle, and where it is practiced it is for the sake of building up interaction rather than for the practical purposes just described.

Sharing, therefore, is an activity in which people give each other, or let each other take, similar or identical objects or materials; trade is an activity in which they exchange different kinds of objects or materials. Trade is a corollary of the true division of labor, sharing is not.

The Amount of Trade. All peoples in the world practice a certain amount of trading, but among many this is limited to a few simple objects such as spears, cutting tools, and red ocher for body paint. People who practice this minimum of trade produce all of their own food locally and individually by families or, as in the case of the Bushmen described above, by groups of families which share certain products. Although some may dig more ocher than others, and some cut saplings for spears while others do not, in such societies no one may be called a complete specialist in any given technique. The division of labor is too slight to make an appreciable differ-

ence in the matter which concerns us—the development of complexity in human relations.

Above the level just described we find other people who habitually trade a considerable proportion of their products, while raising or gathering most of their food and making some of their secondary tools, clothing, and the like within the family. Again we find people who sell or trade all of their products and buy in exchange everything that they need.

The amount of trade will serve as a good index of the complexity of a people's adjustment to the environment because of its relation to the division of labor, and because trade is a form of interaction, and hence the more complex the trading system, the more complex the human relations of the people concerned.

Trade and the Division of Labor. Let us examine the relation between trade and the division of labor. A specialist has to trade in order to get rid of his surplus and receive other people's goods in return. If he is a blacksmith in a Negro village in Central or East Africa, he spends most of his time forging hoes, knives, spears, and other tools and weapons in his smithy, and his wives raise most of the food which his family needs. His clients buy his products with chickens, goats, and other commodities, so that therefore he and his family are plentifully supplied with all of the materials and objects normally used by the people in his area.

This blacksmith is a full-time specialist; the people who use his products are not. But at the same time, they are not complete jacks-of-all-trades, for they do not have to make their own cutting tools; hence they can spend more time at agriculture, hunting, and other pursuits than would otherwise be the case. If a white trader comes into the district, bringing with him a number of commodities, particularly cotton sheeting, the women, who formerly wove the cloth worn by their families from cotton grown on their own fields, can now plant more land in food crops and in tobacco, and the increase will pay for the white man's cloth.

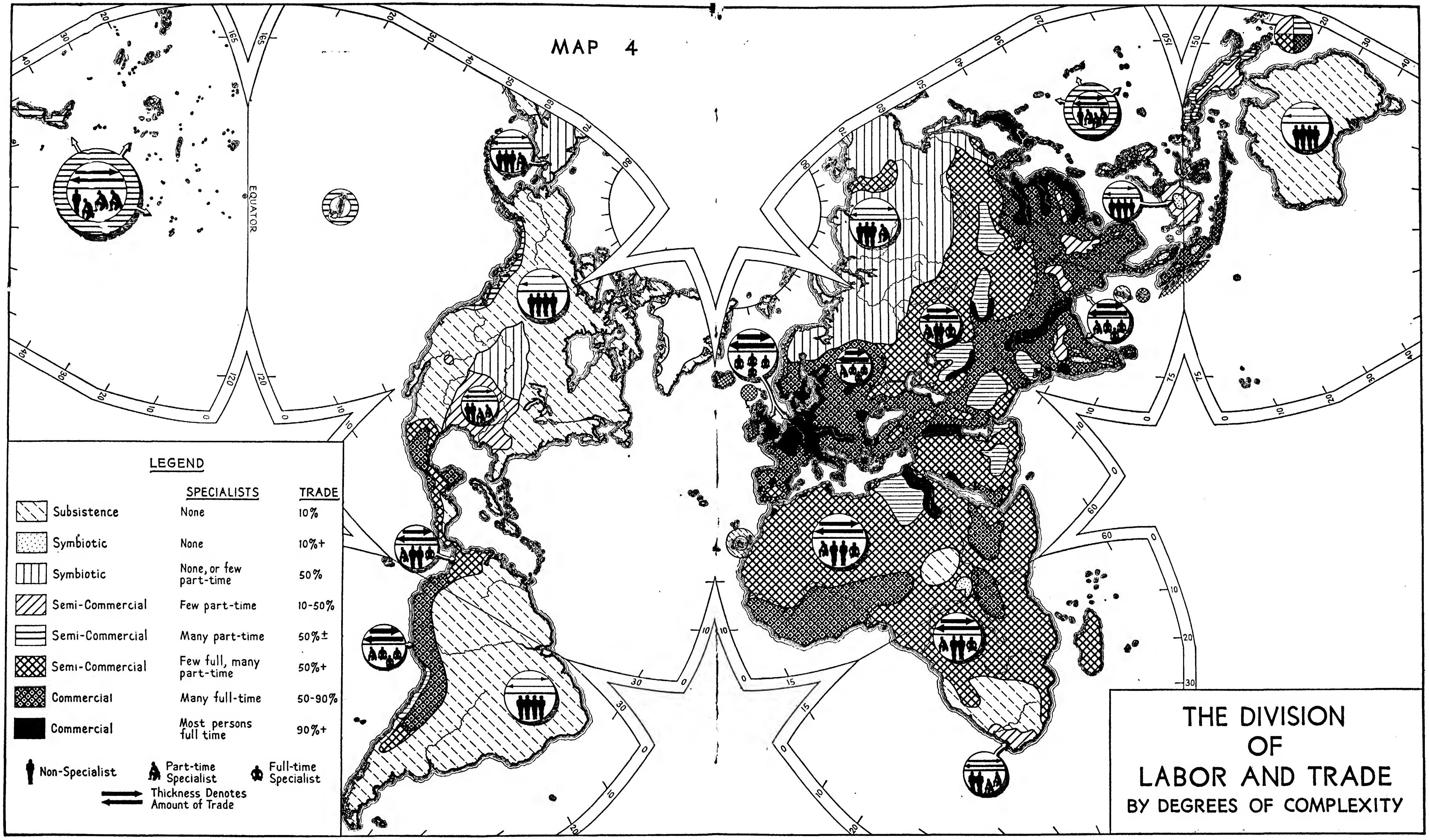
As these people come to buy more kinds of things from the trader, they can spend more and more time at their farming and concentrate more and more on special crops; soon they are full-time farmers, letting small handicrafts go and producing a considerable surplus which they trade. Then the government builds a motor road past their village, and it is now easier for the trader to dispose of the surplus crops and to get goods to give in exchange.

Now the soil of this region is of a peculiar type, and although most tropical crops will grow on it well enough, it is particularly suited for the

cultivation of a high-grade tobacco. Hence the local farmers plant more and more of their land in tobacco and less and less in food crops, until eventually some of them, who own the best tobacco land, may come to buy their food from others, and thus become full-time specialists. The process by which a given farmer in this area becomes a specialist is different from that of the blacksmith; the farmer becomes one by the gradual elimination of other techniques, while the blacksmith did so by apprenticing himself as a boy and devoting himself to his chosen technique from the start. One point to this example is that a person is a specialist if he performs but one technique, no matter what it is; a cash-crop farmer is just as much of a specialist as a blacksmith or factory worker. Another point is that in any community in which there is a full-time specialist serving the other members, those whom he serves are at least part-time specialists by the elimination of one or more techniques through trade.

Direct and Indirect Trade. From our present standpoint, the amount of trade which people practice is a valid criterion of the complexity of their technological adjustment to their environment, and we are not at the moment concerned with the distance over which their products are exchanged, or with the relative amount of direct interaction between the parties to the exchange. People who buy sugar and candles at a store usually do not care, and often do not know, where the sugar and candles originally come from, or what they are made of, as long as they are satisfactory. As in the case of involved techniques, the people who handle a given object in an involved system of trade usually do not know each other, and most of them have nothing to do with each other beyond their immediate shares in the transaction. Thus the white man who sells cloth to Negroes gets it by truck from a seaport, whence it has come by ship from Liverpool or New York. It was woven in an American mill or in Manchester from cotton grown in the United States. The tobacco which he obtains in trade for the cloth goes to England, where it is blended with American tobacco and made into cigarettes which will be smoked everywhere from the Outer Hebrides to New Zealand.

There is, therefore, a profound quantitative difference between the amount of interaction involved in simple exchange, in which one man gives another man something that he has gathered, raised, or made, in return for the second man's product, and complex exchange, illustrated above. Elaborate trade, like elaborate techniques and an elaborate division of labor, usually involves indirect, as well as direct, human relations, and are all related and interdependent phenomena.



The information on which Maps 3, 4, 5, and 6 are based is not completely satisfactory. Although there is little difficulty in locating peoples, the exact boundaries of their territories are frequently unknown or ambiguous. Moreover, in determining details on technology, trade, the division of labor, institutions and ritual symbols, the evidence is rarely systematic and likely to be unreliable. Nevertheless we believe that these maps represent clearly the general relationships illustrated, even though in some cases we have had to make arbitrary decisions.

III. THE MEASUREMENT OF COMPLEXITY IN TECHNOLOGIES

As we have seen, the systems of technology by which different people adjust themselves to their external environments vary in complexity in terms of: (1) the extent of the division of labor found among the people concerned, and (2) the amount of trade which they practice. If we wish to measure the relative complexity of technologies, therefore, we must find some yardstick to apply to either or both of these variables.

We cannot use the amount of goods produced, for quantities vary with kinds of commodities; a ton of metal is much more valuable and takes more work to produce than a ton of apples. We cannot, furthermore, use dollars and cents value, for market values of commodities vary from place to place and time to time. The one yardstick which does not vary, however, is TIME; one man's working time, hour by hour and day by day, can be compared to that of another man, even if one is a Hottentot and the other a modern American.

Let us attempt to apply this yardstick of time, therefore, to our two variables. In the case of the division of labor this can be done in two ways, as follows:

1. We can measure the amount of time which an individual spends at a specific technique in proportion to the amount of time spent at all techniques. In order to determine whether or not he is a specialist to any partial extent, we must find out whether or not his time schedule differs from those of his neighbors or associates or people with whom he exchanges goods. This measurement must be done over a long period to eliminate the effect of seasonal changes. By using this system we may determine, for example, that individual A, who makes shoes in a factory all the year round, is a full-time specialist, devoting 100 percent of his working time to this technique. The farmer who works six months each year at shoemaking, however, is by the same token a 50 percent specialist at this technique.

2. In the same way, one might measure the amount of time that an individual spends in the pursuit of trade, out of his total working time. Trading populations can be defined in terms of this measure, regardless of the quantity or value of the goods that change hands.

3. We can calculate the relative numbers of both full-time and part-time specialists living in any area. Both of these figures would likewise vary from 0 to 100 percent.

4. Again, we might calculate the ratios of full-time and part-time traders and merchants in any given area.

5. There is one further index, which is to combine numbers 3 and 4, and estimate the proportion of full- and part-time specialists and full- and

part-time traders. In certain cases, as we shall see, these two factors may have unequal values, and special types of adjustment are indicated.

To sum up the above criteria briefly, they are:

1. The relative amount of working time which the individual spends at a special technique.

2. The relative amount of working time which he spends in trade.

3. The ratios of full- and part-time specialists to a population.

4. The ratios of full- and part-time traders to a population.

5. The combination of 3 and 4.

All of these criteria are difficult to apply to a population, only because we do not possess sufficient published information. However, our knowledge of the activities of individuals in most regions is detailed enough so that we can make a working estimate of these criteria on the scale from 0 to 100 percent, with no more than a 10 to 20 percent margin of error in most cases. In view of the roughness of these estimates and their differences in reliability, it would be futile to divide our scale into a large number of small percentile categories, and make an elaborate system of classification.

We will be as accurate as the material allows, however, if we divide the scale into three categories, the first centered at 0 to 10 percent, the second at 50 percent, and the third at 90 to 100 percent. The reason why we have left this 10 percent leeway at either end of the scale is not in this case a lack of accuracy in the available data, but a recognition of the fact that all people, however simple their way of living, practice a little trade, while many full-time specialists and their families consume some of the goods which they produce.

Stages of Technological Complexity. With these metrical standards in view, we are now prepared to designate a number of stages of technological complexity in which all known civilizations can be placed, as shown on Map 4. At the present stage of our knowledge these can be limited to eight, as follows:

1. Subsistence. No specialization, less than 10 percent of trade.
2. Symbiotic. No specialization, trade slight but above 10 percent.
3. Symbiotic. No full-time specialization, but in some cases a little part-time; trade approximating but not exceeding 50 percent.
4. Semi-Commercial. A little part-time specialization, trade above 10 percent but below 50 percent.
5. Semi-Commercial. Much part-time specialization, trade approximating 50 percent.
6. Semi-Commercial. A little full-time and much part-time specialization; trade approximating 50 percent or more.

7. Commercial. Much full-time specialization, trade between 50 and 90 percent.
8. Commercial. All or nearly all persons are full-time specialists, trade approximates or exceeds 90 percent.

These eight stages defined above can be illustrated by a few examples in each case.

1. Subsistence. People who live on the subsistence level are found in all environments. They include such technically simple peoples as the Australians, Bushmen, and Andamanese, the Fuegians, and the Indians of California. They also include peoples who are more advanced technically but whose environments prevent them from amassing surpluses and living in large, concentrated groups, such as the Eskimo and the Indians of the boreal forests of North America and the Nuer of the Sudan, whose country is seasonally flooded. In other words, subsistence peoples are those who have not yet learned advanced techniques, or whose environments inhibit the development of a division of labor and trade.

2. Symbiotic. There are a few groups in the world who have no *internal* division of labor, but who nevertheless obtain special products from their environment and trade them with outside peoples, receiving in return cutting tools and a few other necessities. Most of these peoples live in tropical forests and take advantage of the presence of such commodities as gums and resins, camphor, and animal products which other people want. For example, the Punans of Central Borneo trade swifts' nests, camphor, rattan, and monkeys' gall bladders (to be used for medicine) with the agricultural peoples living on the rivers, in return for metal tools and cloth. The Pygmies of Central Africa supply their Negro neighbors with meat, skins, and ivory, in return for iron, cloth, and some vegetable foods. As Map 4 indicates, there are small colonies of people living by this special arrangement in the tropical forests of the Old World from the Congo to the Philippines. They interact little with outside groups, and owing to their partial specialization and the elimination of such basic techniques as tool-making, their entire adjustment as well as their human relations are extremely simple, simpler than those of most subsistence peoples, who have to practice a greater variety of techniques. The special character of their environment enhances their isolation and inhibits outside interaction beyond that needed for trade. Some of them actually practice silent trade and never see the people with whom they make their exchanges.

3. Symbiotic. In other environments, one also finds people living without internal division of labor, but with a trade relationship with other groups.

Such people are usually pastoral nomads who produce an excess of special animal products, which they exchange with people living in other environments in return for vegetable foods and other necessities, usually including cutting tools. An excellent example of this may be found in the Reindeer Chukchi, who pasture their herds in the forests and tundras of Northeastern Siberia. There is little specialization of labor because there is but one thing to do—care for the animals and conduct them on their seasonal migrations from forest to coast. A few men are traders, but they probably fall below the postulated 10 percent, and most reindeer owners do much of their own trading. They obtain, in return for meat and hides, cutlery and tobacco from the Russians and American sailors, and sea-mammal meat, rich in fats, from the Maritime Chukchi, who live by the same techniques as the Eskimo. The Maritime Chukchi also give them seal and walrus hides which they need for boot-soles and thongs, since reindeer skin is not thick or strong enough for these purposes.

The Lapps, who practice the same profession as the Chukchi, trade with Norwegians and others, receiving cutlery, tobacco, cloth, sugar, and coffee in return for meat and hides. There is a little part-time specialization among the Lapps; some of the poorer men with few reindeer spend more time making sleds, skis, bowls, and other wooden objects during the slack months of early winter than the rich do; the poor men sell these objects, and thus make up for their poverty in livestock.

4. Semi-Commercial. Semi-commercial adjustments are found among food-gatherers, agriculturists, and pastoralists. The Plains Indians have a little specialization at the time of the annual buffalo hunt, but all perform more or less the same activities during the rest of the year. They used to consume much of the meat for food, and trade the rest for maize. Similarly the Kayans and other agriculturalists of Borneo have a little specialization; some men forge krisses and other cutlery out of imported iron, but no one is exempt from agriculture through virtue of practicing any special technique. The Kayans go on annual gathering expeditions in the jungle, and like the Punans trade some jungle products with the people outside their area. The Hottentots were apparently semi-commercial because they hired Bushmen, Bergdama, and others, to do their herding while they went hunting or on war expeditions, and because their blacksmiths were, as far as we can tell, only part-time specialists. Their trade was extremely limited by their lack of agricultural neighbors; in this case the division of labor exceeded the amount of trade.

5. Semi-Commercial. The Northwest Coast Indians belonged to this level, because although most of the people joined in the fishing activities

during the annual salmon run, at other times they specialized in such techniques as house-building, canoe-making, and trading, and because they had a considerable volume of trade from California to Alaska. This is likewise true of many of the Melanesians, who spent most of their time farming and fishing, but who included a large number of semi-specialists at the techniques of tapa beating, shell-money grinding, canoe-making, and the like; the Polynesians were similarly specialized. Both the Melanesians and Polynesians practiced extensive sea trade.

6. *Semi-Commercial.* The chief difference between this and the preceding level is that in this one there are a few full-time specialists in most communities; hence most of the simpler peoples who make metal cutting tools, with ore which they smelt themselves, belong to this category. Most of the Negro tribes of Africa, who have one or two blacksmiths in each neighborhood, will serve as examples, as will the Berbers of North Africa, who carry on an extensive trade in dried fruits and olive oil, with a resident blacksmith in each community and a few specialists in trading at each market center. Similarly the camel nomads of Arabia, who likewise have a blacksmith in each camp, are typical of this level.

7. *Commercial.* Good examples of people who have a number of full-time specialists in production and trade, and who trade goods extensively, are the Aztecs of the time of Montezuma and the Incas, as well as the rural populations of Europe, India, and China. Their technologies do not need to be described here.

8. *Commercial.* In contrast to the rural regions just mentioned above, is the situation in which everyone is a specialist of some sort, and in which each person normally disposes of all or almost all of his products by trade. This situation is found only in the most highly complex urban areas of the Old World, in Western Europe, Egypt, Mesopotamia, India, China, and modern America.

IV. HOW THE COMPLEXITY OF SOCIETIES IS MEASURED BY THE DIVISION OF LABOR, AND TRADE, AND HOW THESE DEPEND ON ENVIRONMENT AND TECHNOLOGY

In Chapter 10 we pointed out how particular combinations of techniques had specific limitations in different environments. For example, we saw how the polar environment permits only hunting and reindeer-breeding, and supports a sparse population, while a Mediterranean climate permits certain kinds of agriculture and animal-breeding and inhibits others. It can easily be seen how these interrelations play a determining part in the development of the division of labor and trade, and we would expect from the evidence

given in Chapter 10 that there would be a close relationship between environment, technology, and the complexity of civilizations as we have defined it. Map 4 shows the geographical distribution of our eight categories in the division of labor and trade; the student should compare this with the preceding maps in this section. In illustration of the way in which environment and technology together affect the division of labor and trade, we shall consider the principal environments discussed in Chapter 5 from this standpoint.

1. Dry Lands. As we have seen, several drylands areas of the world still contain, in the ethnographic present, populations which use chipped flint tools, acquire food by hunting and collecting, and have no advanced means of transportation. None of these populations include specialists, and in all of them trade is extremely limited, because their economy keeps everyone busy in the search for food. The drylands environment will not permit specialization at this technological level because the minimum requirements for food keep everyone busy. In the terms which we have employed in the preceding sections of this chapter, all drylands gatherers with flint implements are subsistence gatherers.

Drylands agriculture, however, whether practiced with polished stone or metal implements, usually permits some specialization under any circumstances, since the crop yield of oases and seepage fields is high. The amount of trade between dryland farmers and other people depends largely on the techniques of transportation available, and the amount of specialization depends largely on the amount of trade. For example, the Hopi have always traded maize and some cotton cloth to the neighboring hunters in return for meat; despite the fact that this trade has been largely carried on by foot transport, its volume has been sufficient to permit part-time specialization in weaving. This part-time specialization has been of a seasonal nature, being a winter occupation, but the weavers would have spent far less time at their looms if they had had no market for their cloth.

In the Central Asiatic oases, which serve as way-stations for camel caravans, many people are full-time specialists, weaving rugs out of wool brought them by people who specialize in animal husbandry in grasslands. On the coast of Peru, there were factories of full-time weavers making cloth of llama wool brought down from the highlands. The surplus of foodstuffs grown under irrigation in the coastal gardens made this specialization possible.

Similarly the Bedawin who pasture camels on the Arabian desert are part-time specialists in that they devote their energies to raising camels, some of which they exchange for vegetable foods, cloth, and metal implements. In each camp there is a full-time specialist who processes iron for the rest of

the inhabitants, repairing their tools and shoeing their horses. He is fed from the surplus which they produce. Even the Sloubbies are specialists in their hunting and tinkering. Although they are pure food-gatherers, they differ from the subsistence food-gatherers of the Australian and South African deserts, because they are dependent on their interaction with others for their survival.

As we said in the last chapter, mineral extraction and advanced means of transport permit a maximum exploitation of drylands; this is entirely due to the fact that these techniques necessitate an extensive division of labor and trade, as in the case of the state of Nevada, where most of the food is imported.

2. Tropical Forests. In the tropical forests of the world, where the environment severely limits available natural food materials, the technological system followed is of extreme importance. Food-gatherers with chipped flint implements have no specialization and almost no trade; those, like the Pygmies and the Punans, who can obtain iron implements, can concentrate on the collection of special materials which they can trade to agriculturalists. Since these forest gatherers have to spend their time scattered in small groups in the jungle, they can develop no elaborate pattern of interaction and no specialization despite their trade.

Most of the slash-and-burn agriculturalists of the tropical forests live on a subsistence basis, with little or no trade and no full-time specialists in economic activities, because of the extreme difficulty of clearing the ground and making crops grow in abundance. The introduction of a domestic animal suitable for tropical forest living and for traction, that is, the water-buffalo, permitted a dense population to live in the tropical forest areas of Southeastern Asia, and in some of the islands of Indonesia, because it permitted the adoption of a new type of agriculture. With advanced agricultural methods, these people could accumulate food surpluses, which could be exchanged for manufactured objects, and this contributed to the support of specialists. In Bali, for example, these conditions resulted in a multiplicity of traders and specialists, and an efflorescence of highly skilled artists such as woodcarvers, musicians, and dancers.

3. Mediterranean Lands. As we have seen, food-gatherers in Mediterranean climates do not develop into specialists. In Australia and South Africa, they practiced the same techniques as the people living in the grasslands and deserts, and differed only in their greater population density and lesser need for mobility. In California especially, the result of an abundance of wild foods on a people with chipped implements and no transportation was merely to increase the population and to reduce the geographical range

of each village. Each village had all of the materials it needed and there was little trade, and hence no division of labor. Thus it is clear that environment alone cannot produce a division of labor; it can only do so if associated with the proper technology.

In the Mediterranean proper, the local farmers, using simple cutting tools of metal, and animal and ship transportation, produce large surpluses of agricultural products, such as olive oil and wine, and one finds whole villages of semi-specialists in agriculture, while the countryside supports towns of people engaged in full-time commerce and manufacturing. In California the same landscape which produced no specialists under aboriginal conditions now harbors millions of men, because they employ advanced techniques of agriculture, including irrigation as well as equally advanced techniques of manufacturing and transportation.

4. Mid-Latitude Mixed Forests. We have few examples of peoples living in this climate without the combination of metal tools, husbandry, and good transportation. Those which we have, however, are sufficient to let us determine the point in the balance between technology and environment at which specialization enters. The Tasmanians, who were on the lowest technological level in terms of our criteria, had no division of labor. The Canoe Indians of Chile and Tierra del Fuego, who were limited to chipped flint implements, had none likewise. In North America, the Indians of the Plateau country, who used polished stone cutting tools and had good canoes, were also unable to develop a division of labor in this environment. It was only on the Northwest Coast, with its unique abundance of salmon, that food-gatherers could acquire a surplus, attain seasonal leisure, and develop into part-time specialists. We use the term "part-time" because all of them worked together during the fishing season; the canoe-builders and house-builders worked at their tasks only during the off-season. One tribe, the Nootka, produced a group of specialists in whaling; the Haida, after the introduction of iron tools, developed specialists in totem-pole carving who went up and down the coast providing other tribesmen with suitable family emblems. The Northwest Coast Indians represent one of the few groups of food-gatherers in the world who succeeded in developing a division of labor, even if only part-time; this can be attributed directly to two factors—their special environment, including both salmon and cedar, and their possession of good polished stone tools with which they could make not only their houses, wooden boxes and the like, for which the cedar was particularly suited, but also good sea-going canoes and fish weirs.

Of the other peoples living in this environment, and using the techniques of husbandry with metal tools, the degree of specialization is largely

a function of the relative excellence of transportation. In medieval Europe, where most of the goods were carried by wagon over poor roads, the majority of the people were farmers, and relatively few were full-time specialists. In modern Western Europe and in America, where methods of transportation have been perfected, almost all, even the farmers, are specialists; the division of labor is complete and trade at a maximum.

5. Grasslands. As we have seen, food-gatherers who hunt and collect on foot in grasslands live on the same level of adjustment as those in drylands and Mediterranean climates; they cannot develop a division of labor or extensive trade. When, however, they acquire horses and metal cutting tools, some part-time specialization is possible if the food supply is abundant, as is the case of the Plains Indians who hunted buffalo. The Indians of the Northwest Coast had a potential abundance of food which they needed to collect only seasonally, and both these peoples had good transport, good tools, and efficient methods of food preservation. Both likewise developed part-time specialization. However, the specialization of the Plains Indians was less than that of the Northwest Coast people, since the former had to migrate after their seasonal food supply, while the latter could live in permanent villages and wait for their food to come to them. Neither the natural abundance of food, however, nor the techniques, was sufficient alone in either of these two examples; the two had to occur together.

Agriculture on grasslands likewise depends on advanced implements and advanced transport, if it is to be effective. The African savanna agriculturists were no better off than the tropical forest people, and used the same system; the grasslands farmers of North America could ordinarily till the river banks only. In both areas there was a moderate amount of specialization and of trade. Pastoralists who live on grasslands, however, are nearly always part-time specialists and traders, in that they depend on others for some of their food and implements, as is also true of pastoralists living on deserts. Modern stock-raising and wheat-farming on grasslands are the direct result of the application of an advanced technology to this environment; modern stockmen and wheat farmers are all specialists who dispose of their products in national markets.

6. The Boreal Forests. The boreal forests, as we have seen, provide a minimum of wild vegetable and animal foods, but an abundance of materials useful in manufacturing, such as wood, minerals, and furs. Hence they prevent people who for technological reasons must subsist off the landscape from developing a division of labor or extensive trade. The only technique by which people who get their food directly from the landscape can

develop any division of labor or more than a minimum of trade in this environment is reindeer-breeding, which we have described elsewhere.

The boreal forests inhibit the division of labor at all technological levels. This is due to the fact that cultivated plants will not grow in this environment, and that neither wild nor domestic animals can find sufficient feed in them to become numerous. In this forest environment, people have to have good cutting tools with which they can fell trees, and good methods of transportation; these things, however, are needed for survival alone; no techniques short of those produced by the machine age can permit specialization.

7. Polar Lands. The polar lands are equally, if not more, forbidding, and also require excellent techniques in cutting tools, in transportation, in house-making, in clothing, and in many other departments of technology if people are to survive. They completely inhibit a division of labor and any extensive trade.

Conclusion. Whether or not a population develops a division of labor and trade depends on two factors; the amount of surplus, if any, which they produce, and the degree to which they can transport and exchange products. These two factors are directly determined by the environment in question, in terms of the techniques which they use to exploit it.

The simpler the techniques, the more difficult it is, in any environment, to produce a surplus. In most environments, people who practice complex techniques can produce a surplus and can transport it and exchange it, and hence can arrive at a division of labor. In some environments, particularly in the boreal forests and the polar lands, it is impossible under almost any known combination of techniques to produce the conditions which permit a division of labor.

Just as people can survive in some environments with a minimum of technological equipment while they need a better equipment to survive in others, so the technological level at which a division of labor can be attained is lower in some environments than in others. People who live today without a division of labor occupy the lands in which this cannot easily be achieved; in the lands in which complex civilizations began, the threshold of environmental opportunity in terms of techniques must have been lower. In other words, complex civilization did not begin in the Old World, in Western Asia and the Eastern Mediterranean, by accident, or because the people who lived there were necessarily more intelligent than others; it probably began there because the environmental opportunity in terms of a given technology was greater. One can, in the same way, explain the origins of a complex adjustment in the Andean area of the Western Hemisphere.

As we shall see in Part III, the influence of technology in specific environments in producing trade and a division of labor results in the development of institutions. These institutions differ in their complexity, and these differences may be directly related to these fundamental factors which we have just considered.

SUMMARY

Differences in the complexity of technologies, i.e., of the adjustments of different peoples to their landscapes, are quantitative and vary functionally in concert with differences in the complexity of human relations. The variations in tools and forces and actions used in techniques are reflected in variations in the interaction element of the techniques as well. There is a definite progression in the complexity of human societies on this basis. The deciding factor is the degree of specialization, or the division of labor.

There are three kinds of division of labor: (1) the *Age* division, by which people of different ages perform different tasks, according to their degree of training and physical ability; (2) the *Sex* division, by which men and women perform different tasks because of the fact that women are tied down by the duties of childbearing, nursing babies, and caring for small children; and (3) the *True* division of labor, by which different individuals in a society, of the same age and sex, perform different techniques at one time. It is this latter which is concerned with the development of complexity in human relations.

A specialist who spends most or all of his working time on a single technique can develop more skill than a non-specialist, and once this stage has been reached advances in techniques ordinarily occur. Also, a specialist produces a greater amount of goods in a given time than a non-specialist. Specialists must exchange products with each other. To facilitate this exchange specialists in trade arise, so that the workman need take little time away from his task. Thus the degree of specialization in a society and the amount of trade performed by special traders are functionally related.

As techniques are improved, specialists tend to perform only parts of total techniques, until eventually it takes hundreds of men working together to make an object, while only a few may see the finished product. Traders likewise may become specialized within trading companies as the amount of trade in a society increases.

We can measure the relative complexity of a society in terms of the *amount of time* which people spend in specialization and trade, and in the proportion of specialists and traders in the population. These variables will

range from zero in the simplest societies to nearly 100 in our own, with the exception that in complex societies an increasing number of the specialists tabulated are not engaged in technological activities or in trade, but in the techniques of human relations; that is, in such institutional activities as politics and religion, and in the management of workers. In any case, however, we may measure the relative complexity of societies in terms of technology, since this, as we shall see, is likewise the key to the development of relative complexity in institutions.

PART III

The Development of Institutions

CHAPTER 12

The Family

I. THE BASIC CONDITIONS WHICH PRODUCE THE FAMILY

The immediate, or biological, family, consisting of father, mother, and children, is the most important and widespread of all institutions, and the only one found among all groups of people. It is found not only among all human groups, but also among apes, monkeys, and generally among mammals and birds. The development of the family as a group of habitually interacting individuals is derived from a number of basic circumstances to which all human groups are subject, and which we must consider before we can explain the different forms which the family institution takes among different peoples.

Sex and the Family. The initial factor in the production of the family is the desire of adult individuals for sexual relations. Sexual intercourse is a form of paired interaction which if successfully completed requires accurate timing, and which produces a strong emotional response easily observed by the heightened activity of most of the organs activated by the autonomic nervous system.[1] A man and a woman who are successfully adjusted to each other in their habitual sexual activity are, as a rule, well adjusted to each other in general.

All sexual activity, however, does not produce an habitual association between a pair of individuals. In many animal species sexual activity is purely seasonal, as, for example, among deer and the other ruminants which mate but once a year. In this case the environment has much to do with it; deer mate in the fall, when they are fat and strong from a summer's grazing, and produce their young in the spring, so that the fawns will have the maximum opportunity to prepare themselves for the rigors of winter. Among deer there is no circumstance which would tend to keep the members of opposite sexes together during the bulk of the year, when the does are not in heat and do not stimulate the bucks sexually. The fawn is dependent

[1] Boas, E. P., and Goldschmidt, E. F., *The Heart Rate*, Baltimore, 1932.

upon its mother during the summer months, but has no need for the services of the father. Hence among deer and similar animals, no family institution has developed.

Among the sub-human primates, however, including monkeys and apes, there are two related reasons why groups of procreating adults should remain permanently together. In the first place, all monkeys and apes live in tropical climates, where there is little seasonal change, and where the young may be born at any season with equal chances of survival. In the second place, all of them maintain an open sexual season; there are no periods of "heat," or intense sexual activity, followed by periods of inaction. Anyone who has observed monkeys and apes will know that they have sexual relations frequently; in some species daily. Man, whatever environment he lives in, is still a tropical animal physiologically; as we have seen, he creates his environment by means of houses, fire, and clothing. Like the monkeys and apes, he is able to interact sexually at any time or season, and his offspring may be born at any time of year.

Among monkeys and apes, a certain amount of sexual activity takes place at random, but, as field studies of primates living in their natural habitat have shown, there is always a tendency for an individual male to pair up with an individual female, or, as in the case of the gorilla, with several females. One reason for selective mating, of a more or less permanent nature, is the fact that once a pair of individuals have established a satisfactory interaction rate in terms of sex, which produces a state of equilibrium between them, they are likely to continue their relationship for some period of time and become conditioned to each other. All primates mate selectively; there is no such thing as "group marriage," nor any condition in which all sexual relations are purely random in any group of monkeys, apes, or men yet studied. In man, for reasons which will shortly appear, this would be impossible.

The Care and Conditioning of the Infant. The second major incentive to the development of the family is the need of caring for the infant during its lengthy period of helplessness. All monkeys and apes share this peculiarity with man; the mother must nurse the offspring and guard it against danger, and carry it around with her for a long time before it is able to move about and find food for itself. Particularly in the case of tree-climbing animals like monkeys and apes it is necessary for the mother to keep constant watch; a moment's neglect might mean a fatal tumble. This need for constant attention, therefore, brings about a high frequency of interaction between mother and child—much higher than in the case of animals which produce more precocious offspring and which live on the ground.

Carpenter, whose study of the howler monkey in its native habitat is a classic in the primate field,[2] observed how this interaction starts immediately after birth, as follows:

> The mother sat in a sharply flexed posture, and the squirming, grayish-brown infant climbed up her chest to her shoulders and neck. The infant appeared to be wet, and the mother curried and licked its fur. The climbing behavior of the infant was counteracted by the mother's actions of constantly pulling it down to her abdomen.

Shortly after this, the infant howler found one of his mother's nipples, and began suckling. From this time on, for several months, the infant derived the greater part of his nourishment from his mother's breast, and the act of suckling itself brings about a number of events between mother and child. When the troop of howlers is on the march, the mother carries the infant around, clinging to her abdomen or riding on her back, and occasionally the father will carry it instead. Later in life, as the infant grows stronger and acquires more coordination, it learns to follow its mother around, and to accompany her as she moves from tree to tree. This behavior does not involve any "instinctive" mechanism, but merely shows that *the infant monkey is conditioned to respond to the origins of actions of its mother.*

Carpenter reports a series of events between mother and child which show how this conditioning is brought about:

> An infant moved between fifteen and twenty inches away from its mother. Its locomotor patterns were very poorly coordinated. The mother would permit the young one to move away from her repeatedly, then she would retrieve it. At other times she would move away from the infant for a short distance, stop and wait until the infant reached her, and then the series of actions would be repeated.

Similar events occur in every human group of which we have any information—mother and child are almost continually interacting. Children are fed, petted and caressed, sung to sleep, washed, dressed, and taught to walk and talk. Each of these activities, which are so commonplace that ethnologists often fail to describe them, involve one or more events in which the child learns to interact in definite and habitual ways. Not only the mother, but also the father and the older children, take part in these interactions with the infant, and not only is the infant conditioned to interact, but the others have to make adjustments to his demands. Each of these

[2] Carpenter, C. R., *A Field Study of the Behavior and Social Relations of Howling Monkeys,* Comparative Psychology Monographs, Vol. 10, 1934, pp. 1-168.

activities, whether it is the mother nursing the child or the father dandling him on his knee, helps build up a routine of activity which becomes expected and necessary.

A large portion of the day may be made up of events between parents and children, and the differences in family systems which we shall encounter can be shown to be dependent upon these routine relationships within a small family group. The requirements of getting a living, and the daily activities derived from the people's adaptation to their environment, provide the context which determines how often interaction takes place and between whom. If the family lives with the wife's parents, a much higher frequency of events will take place between the child and his maternal relatives, and his ties to them will be stronger. For, as we have seen, the conditioning process is a conditioning to particular persons, and the frequency and duration of interaction are responsible for the strength of the habit.

The Sex Division of Labor and the Family. The human child, therefore, is conditioned to interact with other persons, and to perform the techniques by which he will later be able to provide for himself and his own wife and children. As we have seen, the bulk of the child's earliest interactions are with the mother, since it is the mother who feeds it from her breast and takes care of it. Among the monkeys and apes the presence of the helpless or semi-helpless infant does not prevent the mother from obtaining necessary food, as the sub-human primates' methods of food acquisition are limited to the *simplest collecting techniques,* with which the presence of the infant does not interfere. As we have seen, the father, among the howlers and other primates, occasionally carries the infant, to relieve the mother. The interest which the father shows in the infant is a result of his habitual relation with the mother, and not due to any need for his presence.

Among human beings, however, as we have seen in Part II, more advanced techniques are universally practiced, and many of these cannot be done by women encumbered by nursing infants or partly trained children. The father, therefore, is the hunter, the fisherman, or the full-time manufacturer, performing the more skilled techniques which would be impossible for anyone encumbered by offspring. Since the father provides his share of the food and performs the more skilled of the manufacturing techniques, and since the mother prepares the food for the family, both parents are dependent upon each other, and the children are dependent upon both parents. This sexual division of labor, which we have already discussed in Chapter 11, is a strong factor in keeping a family together, since it makes the adult members mutually dependent upon one another not only for the preservation of equilibrium in interaction through sex, but also for actual

sustenance. Furthermore, since the activities of the two parents are different, the father must ordinarily teach his male offspring the techniques of men, while the mother is in charge of training her daughter. This gives the father a definite place in the conditioning process.

Each of these three basic factors, the desire for sexual interaction, the necessity of caring for and conditioning the helpless infant, and the sexual division of labor, can exist separately outside the family bounds, and many non-familial relationships based on each of these occur. Nevertheless, in all human societies, the fundamental grouping, the basic aggregate of individuals who habitually interact at a high frequency with each other, is the family, which is automatically held together by the factors which we have just described, and which fundamentally consists of a father, a mother, and children, although many variations occur, each of which can be explained in terms of environment, techniques, accidents of birth and death, and differences of personality.

II. SET EVENTS AND THE DEVELOPMENT OF SETS

As we have just seen, pair events between mother and child, husband and wife, father and child, brother and sister, etc., are always occurring in the family. They are part of the daily routines at the particular level of technological development attained by the group. Whether the family consists of food-gatherers or manufacturers, these routines contain familiar elements; preparing the meals, cleaning the house, dressing and looking after the children, eating, and going to bed. Where a number of people are living together, these events between two people are interspersed with events in which more than one person responds to someone's origin. These are called *set, or group, events* (see Chapter 3), and they occur naturally in the course of the techniques, as one person directs several others where to put a heavy burden, or when a mother sends her children out to play. They may occur in the course of the interaction after an evening meal in response to a joke or a loud cry.

These set, or group, events are important because they are responsible for determining the form of the family system, that is, the order in which individuals interact. It is obvious that if nothing ever occurred but pair events, everyone would originate to everyone else and everyone would terminate to everyone else. A family or any other group would be formless, that is, no individuals would be arranged in common positions in interaction with others. The set event, however, categorizes people; they learn to originate to groups and to respond in groups. The fact that certain individuals obtain responses to their origins from the same individuals brings them to-

gether into a common position in reference to those people. Thus in most families in various societies parents originate action to their children, telling them to be silent, to leave the room, or to help in some household task. Males order females about, and females order males, and older children originate to younger. Here again, these events are commonplace; they occur frequently in family life, although some are more frequent than others.

Ordinarily, to our regret, the ethnological field worker, on whose findings we are dependent for our information, neglects to report these routine set events in his notebook. Instead he tells us merely that the father is dominant in the family, that the parents instruct the children, or that the older children are responsible for the behavior of the younger.[3] Unless an example is dramatic, that is, unless it occurs in association with some marked disturbance in the group's equilibrium, which meets the observer's eye, he neglects routine group events. At least he does so in his descriptions of the family, although he may not in dealing with political, economic and religious institutions, as we shall see later. Despite the inadequacy of most reports in this respect, enough evidence exists to show how set events shape the family structure. Within the immediate family we frequently find, as one would expect, set events in which parents originate action to children, males to females, females to males, and older children to younger. A few examples will illustrate this type of event.

> [In Orokaiva, New Guinea] a man named Tiembo set off to the garden, accompanied by his wife, his two young daughters and his dog. The dog set upon a neighbor's pig, and Tiembo, a fond parent but a very excitable man, set upon his wife and elder daughter and thrashed them for not minding the dog. The girl, in a mixture of anger, grief and indignation, absented herself from home for two days, and the wife, in a huff, delayed the cooking of her husband's dinner that evening.[4]

Here the man originates action to the women, which is followed by a disturbance in equilibrium, in the form of changes in the relations of wife to husband, and older daughter to her father.

The occurrence of set events between older and younger children is well illustrated by another example reported by Beatrice Blackwood from Bougainville:

> A favorite amusement of one group of children was to set two babies about a year old a little distance away from them, and then attract their attention, so

[3] These summaries are ordinarily not enough, as we have no way of checking their accuracy or learning precisely to what observations the words used refer.

[4] Williams, F. E., *Orokaiva Society*, London, Humphrey Milford, 1930, p. 91.

that they made for the other children, who watched to see which of them got there first. This was done so often that it appeared almost like an organized game, the babies enjoying it as much as the older children.[5]

Sets. Whenever set events occur, the individuals are automatically arranged in terms of those to whom they originate. Thus parents originate action to their children who in turn originate to their children, and the parents originate to their children's children. Both parents and the grandparents, therefore, originate action to the same group of individuals, and these same individuals respond in set events to parents and grandparents alike.

Any order of action among individuals which takes an habitual form in group events, as in the cases just cited, is called a *set. A set is an aggregate of relations, of such a nature that every individual is a member of one of three classes in it, as follows:*

A. A class of individuals who only originate.
B. An intermediate class who respond to the origins of Class A and originate to members of Class C.
C. A terminal class of individuals, who only respond, and who do so to the origins of members of both A and B.

Classes A and C must always be present; in many of the simpler sets one finds these two classes only.

At some time every individual in Class A originates action to two or more individuals of Classes B or C, or of both, and they respond. At some other time every individual in Class B originates to two or more members of Class C. At no time, however, do the members of Class C originate to members of A or B in set events, nor does B originate to A. This does not mean, however, that members of lower classes in the set do not originate to those above them; they do this in *pair events,* with frequencies which vary as a function of the set events. If they originate in set events, a new set is in the process of formation. It is characteristic of the set that where there are more than two classes in a set, individuals of the first class must originate directly to those on the bottom, as well as to those immediately below them. If such events do not occur, the set may divide into two parts.

The number of classes in a set varies. In a family, one seldom finds more than three classes—grandparents, parents, and children—although in cases of exceptional longevity and early child-bearing, four or even five may

[5] Blackwood, B., *Both Sides of Buka Passage,* Oxford, Clarendon Press, 1935, p. 170.

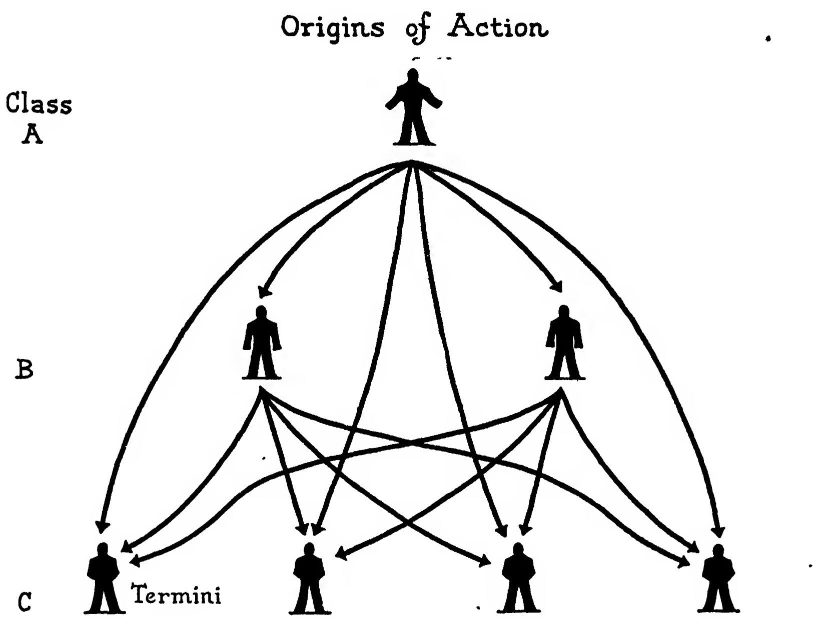


Fig. 3a A Set

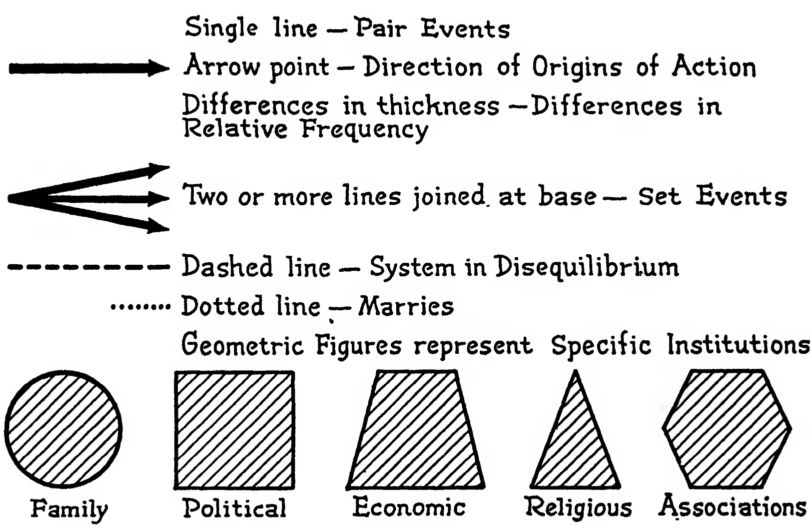


Fig. 3b Principal Symbols Used in Figures

occur. The parent-child relationship has obvious biological limitations. In other kinds of sets, however, as in an army, a modern industrial corporation like General Motors or the American Telephone and Telegraph Company, or in the political organization of a state, there is no such limit to the number of classes between A and C; B may be partitioned a dozen times, since the relative age or parent-child relationship of the individuals concerned is not the deciding factor. However, there is a mechanical limit to the number of classes in a set, which seldom exceed twelve or thirteen.

Sets Within the Family. Within a family one ordinarily finds four sets, since four Class C groups can ordinarily be distinguished.[6]

1. The Parent-Child, or Parental, Set
2. The Female-Male, or Female, Set
3. The Male-Female, or Male, Set
4. The Older-Younger, or Age, Set

All of these sets reflect the conditions which produce the family, as described in the last section. The *Parental* set arises from the fact that the mother and father are obliged to originate to the children when they are helpless infants so that they may survive, and also through childhood and adolescence, in order to train them to perform adult techniques and to interact effectively with their fellows. Thus during early life the children are conditioned to respond to the origins of their parents, and hence continue to do so, for the most part, as long as the latter live. The Parental set is the only set which is unique in the family institution. The other three sets are found in other types of institutions as well.

In most societies, the men in the family will habitually perform one type of activity, the women another; one individual of either sex must, therefore, be in a position to originate to a number of individuals of the other. For example, at noontime on a farm, the housewife may appear on the back porch and ring a bell, summoning the men of the family in from the fields to dinner. On another occasion, a man may go out into the kitchen and compliment the women on their cooking. Thus there is ample opportunity for both the *male* and *female* sets to operate in any ordinary family.

The *Age* set differs from the Parental set, which it superficially resembles, in that it operates only between older and younger children of the same

[6] The reader will observe that two possible sets, the Child-Parent and the Younger-Older, have been omitted, although separate classes of termini for these can be distinguished. The reason for our omission is that except in families where the personalities are definitely abnormal, events of these types occur only in early childhood with any frequency, and do not, as a rule, involve three or more classes.

generation. It is based on the fact that older children in general originate to younger children during the conditioning period in youth, and this order of origins and responses becomes habitual.

Sets and the Size of the Family. It is easy to see that the size of a family will determine the number and complexity of its sets. If a man and his wife are childless, there are no sets in the family at all; such a family is structurally unimportant because of this fact, and childless marriages are notoriously less stable than those which have offspring. In most primitive societies, childless marriages are not allowed to continue; either the husband takes a second wife, or he sends the first one back to her parents and remarries.

If the family consists of father, mother, and one child, only three sets are possible, and these have the minimum personnel in each of the two classes possible; hence the child does not receive an extensive training in set events and, therefore, in leadership—at least, he does not receive it within the family. If, however, there are several children, the membership in each set becomes numerous, and each individual has some opportunity to originate to others in set events, and hence to develop the personality of a leader.

Sets and the Extended Family. So far we have been dealing only with the simple biological family, and its extensions upward and downward in the age scale; i.e., to grandparents and grandchildren. Many families, as we shall see later, live together in related groups, including a group of brothers and their wives and children, or some other such aggregate. The point which we wish to make here is not that such extended families exist, or that they take certain special forms, but that wherever they are found, the four sets which we have just described operate within them as well as within simple family units. In China, for example, it is a common practice for a man and his brother to live in a large house with their sons, their sons' wives, and grandchildren. In such a situation, set events crosscut the individual family lines, as, for example, when the father's brother originates action to his nephew and his children. In a family of this kind there are many more individuals with larger groups of termini (members of Class C), and with more classes in each set than one ordinarily finds in a simple family, and hence the opportunity for the development of leadership is even greater. If such a family is to maintain its sets, there must be stronger leadership, with one individual originating to the others, than in a smaller family unit; the extended family, as we shall see in the next chapter, has the type of leadership often found in a political institution.

It will be clear from this definition that we do not mean by the term "institution" what is implied by such statements as, "Marriage is an *institution,*" or "So-and-so (a famous man) is an *institution.*" These usages are different from ours, and should not be confused with the definition given above.

The Distinction Between Institutions and Techniques. The student must always keep clearly in mind the important distinction between techniques and institutions. In common usage, we are inclined to select certain techniques which are found with considerable frequency in a particular institution and speak of them as family or political or economic techniques. This kind of nomenclature is both misleading and troublesome, because these techniques will crop up in every institution as part of the interaction.

Sexual intercourse might be called a family technique, but it is also found in houses of prostitution, which are economic institutions. Voting is usually thought of as a political activity, but it is not found in all political institutions, and very often it is used in others. For example, the members of a family may vote to determine on what day they shall go for a picnic. Prayer is considered a religious technique, but the workmen in a factory, the crew of a ship, or the students in a school may stop their work to unite in prayer. One of the commonest techniques of all, which is found in all institutions, is the act of eating a meal as a group. Although this technique is more frequent in the family, it is used to maintain or intensify interaction in a factory lunch room, a political banquet, a church supper, and in the rite of communion.

From these examples it is clear that techniques are not indigenous to institutions; serious difficulty arises if, through confusion, one talks about "economic" activity in the family, or "family" techniques in religious institutions. All these techniques make up the technical repertoire of a group. The institutions are defined by the sets of relations which they develop and not by the particular techniques employed in them.

The Effect of Variations in the Frequencies of Sets on Family Institutions. If membership in sets and the relative frequencies of the sets are to remain constant, and the institution is to remain in a state of equilibrium, a degree of isolation is necessary, as specified in the third part of the definition of an institution. If this were not the case, individuals outside the system would be included in set events and would thereby take part in the interaction within the institution. The degree of isolation is, of course, measured in terms of the frequency with which members of an institution interact in external relations.

Institutions vary widely in the degree of isolation of their members. The

most striking cases are found in certain religious institutions, particularly in those monasteries where almost all the inmates spend their lives without interacting with anyone outside the monastery walls. Secret societies also provide well-known examples of such isolation. We shall discuss these cases in later chapters.

Even in families, this principle of isolation can be clearly seen in operation. Among all peoples, each family normally occupies its own house, or a special part of a house, and the house itself is a physical barrier against outside interaction. Australian families, when camping temporarily for the night with no shelters built, occupy separate patches of ground each with its own fire, spatially separated from other families.

When a stranger approaches such a camp, he is supposed to sit outside, at such a distance that he cannot hear the low-pitched conversations of the families in interaction, and he interacts with them only by shouting. In Dobu, one of the Trobriand Islands, a stranger who approaches a house at mealtime may be given food, but he is obliged to eat it sitting on the ground outside the house, with his back turned to the members of the family. Thus he cannot take part in set events with them, but only in pair events, as when someone brings him his food.[7]

Among nomadic Arabs, even the structure of the tent is designed to facilitate this isolation; a curtain in the middle divides it into two rooms, one for the members of the family when no one else is present, and the other for the men and their guests. When the family is alone, the men often stay in the family side with the women, and ordinarily sleep there; when male guests are present, the host and his guests eat and sleep in the men's room, and the women and children in the other. The guests not only fail to eat with the family; they may not even see some of its members.

Our own houses have special rooms for guests to sleep in, and often special parlors in which to entertain them and dining rooms in which to feed them; we do not ordinarily take them into our bedrooms or kitchens. Furthermore, we ordinarily receive guests only at certain times of day, and we do not like it when they appear unannounced at all hours. All of these factors give us the needed privacy, i.e., a degree of isolation which we need if we are to maintain our family equilibrium.

The arrangement of the house is perhaps the most striking technical factor in controlling interaction; it not only defines the degree of isolation of the family from outsiders and the conditions under which interaction can take place, but is also important in controlling the interaction within the

[7] Fortune, Reo, *The Sorcerers of Dobu*, New York, 1932.

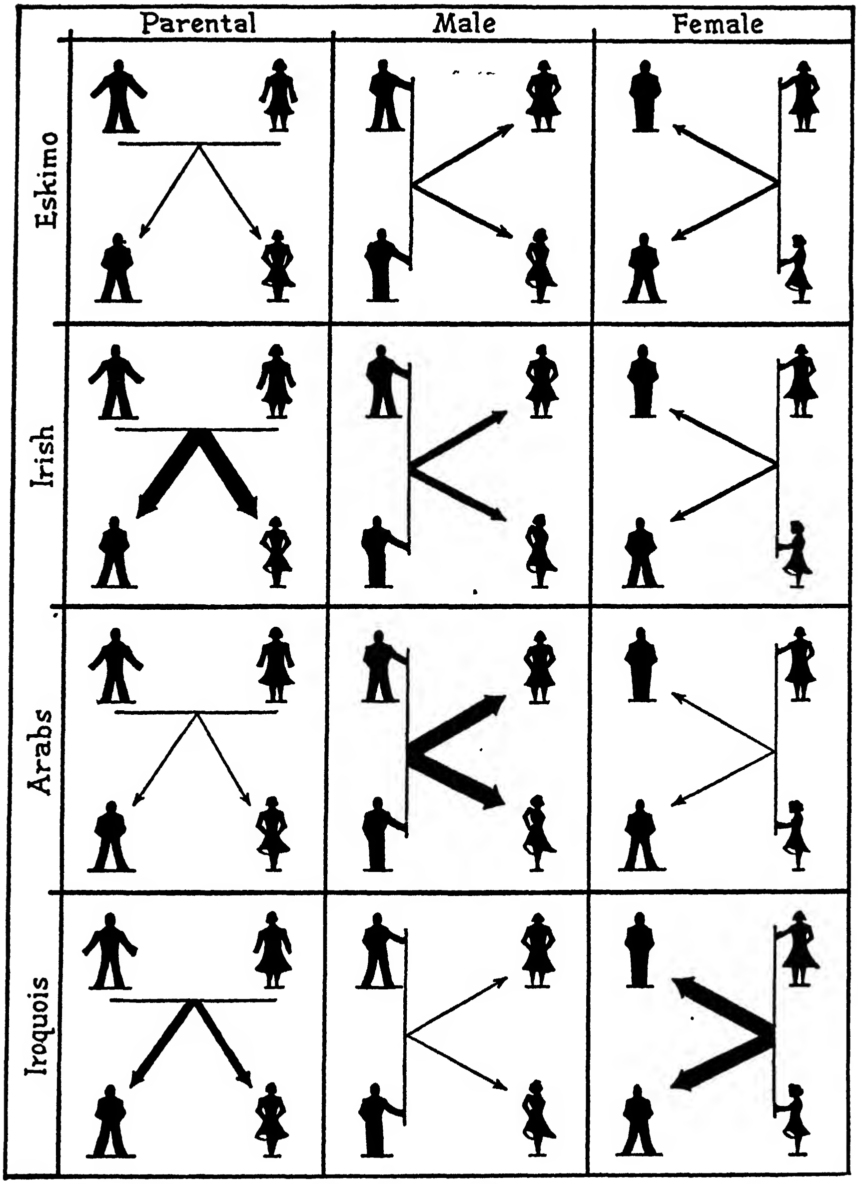


FIG. 4. DIFFERENCES IN FREQUENCY OF SET EVENTS IN FAMILY TYPES.

Note: The total amount of interaction in set events is not the same in all families. In many families, as is often the case in our own society, most interaction is in pair events. The total of all events in the family may also vary greatly.

For key to symbols, see Figure 3b, page 284.

family system itself. In a one-room house, every individual is continually subjected to the stimulus of interaction. The interaction rates are ordinarily higher under these conditions, for the only way to escape it is to leave the house itself. Within the single room, every action for any purpose whatever is a potential disturbance of the existing adjustments. In a house in which every member of the family has his own room, and where there are many rooms for special purposes, the interaction can proceed at a much lower rate and be confined almost entirely to pair events, except in the common meeting ground of the dining room. Even the interaction in the living room or the kitchen may be limited to pair events.

Under such conditions, the conditioning of the members of the different families is markedly dissimilar. The single-room type is much more apt to produce individuals with high interaction rates, with their concomitant "emotional" activity. These individuals, however, are much more prone to set events, both as origins and termini. People brought up in many-room houses have much less opportunity to learn to take part in such group interactions.

The house, however, is not the only important technical factor in determining the form of the family institution. It is most important in defining the degree of isolation in the system and the frequency of the interaction within it. It does not determine the relative frequency of the different sets to one another; this is dependent to a large degree upon the techniques of getting a living, the methods of obtaining food, making necessary utensils and materials. In complex societies, as we shall see in Chapter 17, the frequency of interaction in sets is also dependent upon the interrelationship of the family with other institutions. The characteristic type of American family, in which the father's and mother's kin have approximately equal influence on the family, and the Parental set and the Male and Female sets are relatively low in frequency, is the result of the extensive interaction of the family members in other institutions.

In turning to the family types which arise in simple societies, we have to deal primarily with the results of the division of labor on the basis of age and sex. These are the controlling factors in determining what individuals shall originate within the family group, what persons shall work together, and for how long. Fundamentally, then, we are concerned with explaining differences in family types, in seeing the effect of different technological systems in different environments on the four sets in the family. In fact, it can be shown that these are the determining factors, and that if a group migrates into an area, the requirements of changed environment and

technology will bring about a modification in the family pattern if no other institutions are present.

In any unit family which consists of father, mother, and children, four sets of relations may be in operation: the Parental, Male, Female, and Age. The relative frequency with which each operates, however, is not the same in all families, nor among all peoples. There are, in many societies, local or specific "types" of family, which have been described by various ethnologists under a number of qualitative terms, such as patrilineal, matrilineal, etc.,[8] but which actually can be shown to differ from each other quantitatively in terms of the relative frequency of the four component sets.

IV. ENVIRONMENT, TECHNOLOGY, AND THE FAMILY

It is not our present purpose to illustrate all the different kinds of families which can be identified in terms of the relative frequency of sets. Indeed, this task would be difficult, owing to the paucity of existing knowledge of how these sets work in many societies. We can, however, give a very few examples to show how specific types of families are produced in specific societies in response to given types of environment and of technology. We shall choose examples from relatively simple societies in which institutions other than the family do not play important parts, since in the more complex societies the type of family may be influenced by environment and technology indirectly through the agency of other institutions, which we have not yet studied.

Let us take as our first example the Eskimo, whose environment and technology we have already described in various chapters at considerable length. Among the Eskimo the man's work takes him away from home for considerable lengths of time. Often he can come home at night, but sometimes he has to spend several nights by himself, in which case he builds a temporary shelter each night. The techniques which he practices are for the most part one-man techniques; hunting seal, fishing, and trapping do not require cooperation, and in fact may prevent it. It takes all of his time to provide his family with food and with skins, bone, and ivory, from which most of the family's equipment is made.

[8] The study of kinship systems has heretofore been largely confined to a consideration of the words or *symbols* which people use to designate various relatives, and the classifications which are in common use are based upon these symbols rather than upon behavior. Since words do not change as readily as their referents, and can also take on new meanings, it is apparent that a system based on observed behavior will be more accurate than one based on guesses as to what kind of behavior the words refer. Therefore we shall not use the words "patrilineal" and "matrilineal" unless we specifically infer an inheritance of family names.

His task, therefore, is acquiring materials. His wife's task is largely processing them. She softens the skins, cuts them and sews them into clothing, she prepares the blubber for the lamps, and cooks the food. When her husband comes home she chews his boots to keep the leather from stiffening. She takes care of the young children, and carries her babies inside her fur-shirt next to her back (*not* in the hood, as is popularly supposed). When she has time she also tends traps near home.

An Eskimo man could not live without a wife, nor a woman without a husband. Each absolutely requires the services of the other, and both must work almost all of their waking hours if the family is to survive. Therefore all adult persons are usually married, although in some cases an unattached male may serve as a helper in a family. Since the number of each sex may be unequal, one finds some Eskimo families in which the husband has two wives, and others in which the wife has two husbands. As a rule, however, the Eskimo are monogamous, like most other people. If a man's wife grows old so that she cannot do her work he will marry a younger woman; if a woman's husband becomes senile before her period of activity is finished, she may take another husband.

The Eskimo family is a balanced type of family, in which both males and females originate to each other with a more or less equal frequency, and hence neither the father's nor the mother's kin occupies a position of relative importance in it. The parents originate to the children only enough to see that they learn what to do; many observers have remarked that the Eskimo never punish their children.

A second example is the parental type of family found in western Ireland and carefully described by Arensberg. The peasants of the western counties live for the most part on small family homesteads, which are large enough to support only a man, his wife, and their children. They raise potatoes for their own staple food, and keep a cow or two for milk and butter. Their cash crops are grain and calves, which they take to market periodically. With the cash obtained they buy their clothing and what few manufactured objects are needed. The environment in which they live is cool and damp, with relatively little seasonal variation owing to the Gulf Stream. It is eminently suited to potato growing and to grazing, and since the introduction of the potato every inch of available soil has been given over to farming.

Now when a man marries and has children, he takes the boys into the fields with him to help in the farming. The techniques which he uses are mostly hand techniques, and require no more cooperation than that provided by two or three pairs of hands. Since the boys thus do much of the work on the farm, under the direction of their father, the frequency of set

events from father to son is high. Similarly the daughters work under the direction of their mother. When the day's work is over, however, sons and daughters alike terminate to both parents. This set of relations (the parental) has much to do with the maintenance of equilibrium in the family. Furthermore, the segregation of the sexes in daily work increases the frequency of interaction among the members of each class within the male and female sets. But it is the high frequency of the parental set that gives the Irish family its distinctive character.

In such a family the routine tasks of farm superintendence, made necessary by the techniques of farming used in this particular environment, and consequently the habitual activities of the parental set, are so strongly knit, that on his marriage the son chosen to inherit the farm takes it over, and the father retires from all activity. The other brothers either emigrate, become hired laborers elsewhere, go to work in the towns, or join the clergy; the daughters are married off. The parents leave the main part of the house to live in the "west room," a place of honor reserved for them, in which they are partially isolated from the interaction which goes on in the main room between the son, his wife, and their children.

In view of this system of regulating agricultural affairs, a father will frequently put off arranging his chosen son's marriage and his own retirement as long as he can, and his sons, although they may be fifty years of age, will still be spoken of as "boys" and must continually respond to the origins of action of the father.[9] In the west of Ireland, where this system of relations prevails, a number of factors may be adduced in explanation. Here there is not enough land to go around. If the land of an average family were to be divided, it would not support more than one family; hence only one son can inherit, and hence the late age at marriage. The safety-valve of this situation, of course, has been the ability of the western Irish to emigrate to America and to all parts of the British Empire, whence they can send home remittances.

As a third example we will take the Arab family, as exemplified by the Bedawin of northern Arabia.[10] These people, as we have stated before, live in a desert which will feed only camels, and hence are camel nomads. The men have the greater part of the work to do, herding the camels when they do not have hired servants to do this and, particularly, riding about in search of pasture and water at different times of year, and protecting the herds. They are frequently engaged in fighting their nomadic rivals in the search

[9] Arensberg, C. M., *The Irish Countryman*, New York, 1937.

[10] Chief source of information: Musil, A., *Manners and Customs of the Ruwalla Bedawin*, Mem. Am. Geogr. Soc. N. Y., 1928.

for water and pasture, and fighting is eminently a masculine concern. The occupations of the women are limited largely to preparing food, making clothing, and pitching and unpitching tents. Even among those Arabs who are not camel herders but farmers, plow agriculture, transport, and commerce are the principal occupations, and these are all masculine occupations.

The Arab family is, when possible, polygynous. The men tell the women what to do, and keep them secluded in separate parts of the tent or house, to prevent them from interacting with men of other families. The men, however, can go and come as they please. They can not only originate to the women at will, but also leave if they wish when the women try to originate to them. If a conflict arises between a man and one wife, he can, in many cases, restore his equilibrium by consorting with another. Even small boys sometimes originate to the womenfolk of the family, demanding to be waited on, although, needless to say, this does not always evoke the expected response. When no one else is present, the women often laugh at them. The girls, however, work with their mothers, and ordinarily terminate to both parents as well as to males in general. In this type of family, the parents do not ordinarily order their children around, nor reprove them unless they are doing something dangerous. They usually originate to their children no more than the ordinary requirements of training make necessary. The primary attitude of a father toward his son is that here is another warrior, to fight for the family and defend its members as well as its herds. In the kind of warfare in which the Arabs indulge, it is not the old man, but the brave young man who is alert and bold and who at the same time has good judgment who is the best fighter. In Ireland a man reaches his peak of efficiency in his forties; in Arabia in his twenties.

As a final example we shall consider the type of family found among slash-and-burn agriculturists without domestic animals, who live in tropical or temperate forest environments. These are the environments in which the women do most of the work, providing food for the family, cultivating small plots of vegetables by means of the digging stick or hoe, while the men go off for weeks at a time hunting or fighting. Among many of these peoples a man must bring home either a head or a scalp to prove his manhood before he can get married. Among such peoples the environment and the techniques by which they exploit it make the support of the family the primary concern of the women. For that reason the frequency of interaction in the female set is usually strong, and that of the parental may be strong as well. It must be remembered that here warfare serves a different purpose than in Arabia; here it serves as a means of obtaining political

status; in Arabia it is an essential part of the work concerned with obtaining food.

A clear example of a type of family living under conditions such as we have described above is that of the Iroquois, among whom the women do almost all of the agricultural work, the housework, and much of the manufacturing for home use besides, while the men are absent for long periods each year, hunting and fighting. The women, who are thus left alone much of the time with their children, are organized into households, each of which includes the unit families living in compartments in a single long house, under the direction of an elderly woman who originates to the others in set events. These other women are her daughters, granddaughters, and lateral kinswomen in the female line. Much of the work which they perform is done in work teams, under the leadership of members of the oldest generation; they work together in planting, weeding, corn husking, and most other activities. Thus a strong system of set events is built up between the parental generations of women, with a large membership in the terminal class.

Several of these households are usually combined into one clan, and clan membership is inherited through the mother. A man will retain his membership in his mother's clan. The older generation of women choose representatives in the government from among their sons and grandsons; a man who belongs to the tribal council, therefore, represents his mother's clan and not that of his wife. The sachem, or chief, of the tribe must always come from a certain specific household within a certain clan. The choice is made as follows: the matron, who is the head of the household, calls together a few old women of her generation, and with their help selects the candidate from among her sons and grandsons. Then she calls together a council of the married women of the clan, so that they can confirm the choice, with about as much chance for dissension as one would find in an American club election.

In a people like the Iroquois it is easy to see how the type of family organization under which they live has arisen, and how it has given rise to the extended family organization briefly described above. In the four examples which we have given, the environments and the techniques used to exploit them have all been different, and hence the types of family organization found have differed likewise. Since there are only so many kinds of environment, and so many technological systems, it would be possible to show how all of the different kinds of family organizations in existence were brought about by the combination of environment and technology, if we had sufficient data.

SUMMARY

The family is the basic human grouping, found at all levels of technological complexity, since it is formed on the basis of biological rather than technological factors. The first and most fundamental of these is the desire of adult individuals for sexual relations. Man, like other primates, can be sexually active at all seasons. Thus a pair consisting of a man and a woman have an incentive to remain together, while the establishment of habitual interaction rates between them through their sexual adjustment tends to enhance the permanency of the union. This is furthered by a second factor, the need of caring for the helpless infant through his rather long conditioning period. This ordinarily requires the services of both parents since all human beings get their living through a sex division of labor.

The family is a system or group of individuals in which set as well as pair events take place; parents originate to children, males to females, females to males, and older children to younger children. The order of interaction in each of these sets becomes habitual, through the fact that parents train their children, and that members of different sex and age groups perform different technical activities. Any group of individuals in which interaction is habitual and in which several sets are present is an institution. In the family these sets are the parent-child, male-to-female, female-to-male, and older-to-younger. In the family or in any other institution the members interact with each other at a greater frequency while the system is in operation than they do with other people. Thus the family is a system in isolation, i.e., an institution.

It is the most basic of all institutions, and is found among all peoples. Among the simplest societies in a technological sense, the family is the only institution present; all activities ordinarily performed by the members of the society take place within the framework of the family, or within a small group of families living and working together, except for minor trading operations and warfare.

Types of family vary in terms of the relative frequencies of the four sets, and these frequencies depend upon the combination of environment and technology in and by which the people live, and on the interrelation of the family with other institutions if others are present. For example, in societies in which most of the techniques require the services of males, as among camel herders in the Arabian desert, the males originate at high frequency to the females, and to each other, and the Arab type of family, with seclusion of women and other characteristic features, is the result. In tropical forests where the women do the slash-and-burn farming while the men hunt

and go on war parties, it is the women who perform the essential techniques, and hence there is a tendency for them to own the land and the houses, and for their children to be brought up by their mothers' relatives. In such cases the child is conditioned to interact more with his mother's than with his father's kinsmen and a characteristic type of family is the result.

CHAPTER 13

The Interrelations and Extensions of Families

I. INTRODUCTION

In the last chapter we considered the basic human relationships which produce the family, and how the simple or biological family arose, as well as what purposes it serves. We also took the occasion to define what we mean by the word "institution," which is the subject of the rest of this part of the book. We did not, however, discuss marriage, which is necessary if the family is to continue, nor the interrelation of families which marriage produces. As we shall see presently, these interrelations, and other forces as well, often bring about the development of large, extended families, within which individuals carry on extended technological activities and perform ceremonies, which may be split into sub-systems between which associations have arisen, and which may often exist as sovereign states. In the family, therefore, lie the germs of other institutions, just as in the protoplasm of a single cell lie the basic elements which may later be differentiated into separate organs of the body. Before we proceed to discuss the rise of non-familial institutions, we must outline the ramifications of which the family is capable.

II. MARRIAGE—THE INTERRELATION OF FAMILIES

When a man and a woman marry, the new relationship produces a disturbance in the equilibrium of the families concerned. Both the man and the woman have been interacting at more or less fixed rates in isolated systems of relations; as they build up interaction between themselves, their interactions with others must necessarily decrease, and hence within each of the parental families a new equilibrium must be reached. The extent of the disturbance depends in large measure upon the previous degree of isolation of the families. If, as usually happens, the new couple continues to interact with one or both of these families, the adjustment in each family concerned must include the establishment of a stable rate of interaction with the new member. Furthermore, if circumstances permit, the two parental families may establish relations with each other.

In groups where it is customary for the wife to go to live with her hus-

band's family, and particularly if she is obliged to live in the same house with them, she may find the effect of the resultant change in her interaction rate too great, and run home to her mother for comfort. In such a case, the members of her own family usually take her back to her husband. What has happened is that she has broken off her old system of interaction, to which she was adjusted, and has had to establish rates with an entirely new group of individuals. If her earlier life had been very sheltered; i.e., if she had been allowed to interact with but few individuals, the danger of such a disturbance being serious would be correspondingly great.

Among different peoples, a number of techniques have arisen to anticipate disturbances of this kind. One is to send the adolescents to live in special boys' houses and girls' houses—boarding schools in the United States—for a few years before marriage, with the result that the reduction of interaction with their families will be accomplished gradually; another is to have early betrothals. This is a common practice among families whose members, owing to their interactions in other institutions, wish to ally themselves with other families in order to strengthen their positions. When such betrothals occur, the prescribed relationships which ensue have the effect of conditioning the individuals to their new relationships.

In Bougainville, for example, the girl pays long and frequent visits to her prospective husband's people, or else may in some cases live with them. Her prospective husband, however, is kept rigorously apart from her until the marriage. Among other groups, such as the Toda, the prospective bridegroom makes periodic gifts to his future wife's relatives. This involves presents twice a year to the girl, and contributing money towards funeral expenses if a death occurs in the girl's family. These gifts to the girl or her parents are presented by the bridegroom when he visits the family, at which time he ceremoniously responds, as well as originates, to the girl's father, mother, and brother.

Among the Bemba, a South African tribe, the bridegroom goes to live in his bride's village and works in the garden under his father-in-law's direction. During this period of betrothal and early marriage, the bridegroom is fed by his mother-in-law, and the bride continues to eat with her own family. After they are married the young people begin to produce their own food by gradual steps until they have finally become self-supporting. This usually is at about the time they have begun to have children; in other words, when they have become a unit family rather than merely a married couple. One of the best clues to an understanding of the stresses in family systems can be obtained by analyzing the quantitative pattern of the events in the techniques associated with betrothal.

The point to most of these routines of betrothal is that they include a customary series of events which build up not only the relationship between the bride and groom, but also that between the two families. This process may involve a number of origins of action from one family to another, in the form of visits, gifts, and feasts; these may be followed by subsequent origins of action within each family when the gifts which have been received are distributed among the relatives. The relationship may be brought about very suddenly, as in marriage by capture with subsequent compensation, or very slowly, as in infant betrothal; in any case, whether the affair begins suddenly or gradually, there is a long period of interaction before the families have stabilized their relationships.

Go-Betweens as Negotiators of Marriage. Owing to the difficulty of bringing families into relation with each other through marriage in some societies, particularly in cases where property must be transferred or exchanged, a number of peoples customarily use a go-between to interact with both sides, and bring them together after he has worked out an adjustment between them.

Arensberg quotes a statement made to him by a farmer of Inagh, in the west of Ireland, which not only illustrates the way in which a go-between adjusts the claims of the two families in respect to the quality of the farm which the groom is to take over and the amount of the dowry, but also describes the actual order of events in the interaction.[1]

When a young man is on the lookout for a young lady, it is put through his friend for to get a suitable woman for him for his wife. It all goes by friendship and friends [kin relations] and meeting at public houses. . . .

The young man sends a "speaker" to the young lady, and the speaker will sound a note to know what fortune she has, will she suit, and will she marry this Shrove? She and her friends will inquire what kind of man he is, is he nice and steady. And if he suits, they go ahead and tell the speaker to go ahead and "draw it down." So then he goes back to the young man's house and arranges for them to meet in such a place, on such a night and we will see about it. . . .

The speaker goes with the young man and his father that night, and they meet the father of the girl and his friends, or maybe his son and son-in-law. The first drink is called by the young man; the second by the young lady's father.

The young lady's father asks the speaker what fortune does he want. He asks him the place, of how many sheep, cows and horses is it? He asks what makings of a garden are in it; is there plenty of water or spring wells? Is it far

[1] Arensberg, C. M., *The Irish Countryman,* Macmillan, New York, 1937, pp. 73-75.

in from the road, or on it? What kind of house is in it, slate or thatch? Are the cabins good, are they slate or thatch? If it is too far in from the road, he won't take it. Backward places don't grow big fortunes. And he asks too, is it near a chapel or a school, or near town?

Well . . . if it's a nice place near the road, and a place of eight cows, they are sure to ask 350 pounds fortune. Then the young lady's father offers 250, and maybe the boy's father throws off 50. If the young lady's father still has 250 on it, the speaker divides the 50 between them. So now it's 275. Then the young man says that he is not willing to marry without 300 pounds, but if she's a nice girl and a good housekeeper, he'll think of it. So there's another drink by the young man, and then another by the young lady's father, and so on with every second drink till they're near drunk. The speaker gets plenty and has a good day.

This concludes one day's activity, and then the young couple are introduced to one another. After that, the girl's people come to see the land, and if the girl's father likes the land, they drink and feast, and the following day go to the attorney to sign over the land from the boy's father to the boy.

Much the same negotiations occur elsewhere, particularly in China, where the procedure is much longer and more involved. It is a practice found among the Mongols, Tungus, and even among orthodox Jews in New York, some of whom employ marriage brokers to arrange satisfactory unions between families.

The Selection of a Mate. The selection of a mate is an extremely variable procedure. In some societies, such as our own, marriage is more or less free, outside of a limited circle of relatives; that is, it depends upon propinquity and upon an opportunity for free adjustment. In other societies, the bride and groom have no choice, but the families arrange the affair to their own satisfaction. Often too, there are classes of individuals within which one may marry, and other classes which are forbidden. In the latter case, we commonly speak of incest barriers, and much effort has been spent in determining the reasons for such limitations. With the exception of a very few peoples, such as the royal families of the Incas and of Egypt, and the royal clan of the Azande, marriage within the immediate family is forbidden.

In these cases the royal families have already established relations with other families and other institutions of such a character that the members of the royal families habitually originate to everyone else, and respond in set events to no one. For this reason the parental set has broken down within their families, and it creates less disturbance of equilibrium if they marry sisters or daughters than if they marry outsiders. Furthermore, we have ex-

cellent evidence that the princelings and princesses were notably undisciplined, which indicates that the parental set was extremely weak in these families.

There is no evidence, therefore, that the so-called "horror of incest" is instinctive. It seems, in fact, to be a form of conditioning which, in many recorded cases besides those mentioned above, has broken down under the stress of individual situations. This conditioning is due to the need of preserving not only the internal equilibrium of the unit family, but also its equilibrium with other unit families in the same band, tribe, neighborhood, or whatever. As we have seen in Part II, among even the simplest groups of people it is necessary for a number of unit families to have constant relations with each other if they are to survive. The habitual marriage of brothers and sisters, fathers and daughters, etc., would reduce these relations below the necessary minimum of interaction, except in the few cases of royal families mentioned above.

The Marriage of Cousins. However, these relations may be well maintained by the marriage of cousins, and among many people this is the habitual form of mating. Needless to say, a dozen generations of exclusively cousin marriages produce just as inbred a population as would be the case with brother-sister marriage, and hence it is clear that incest restrictions cannot be the result of an instinctive biological impulse to prevent inbreeding.

The marriage of cousins is a convenient system of mating bringing together two individuals who, in most cases, already know each other, and two families which already have some form of adjustment. Hence the changes in interaction rates which result from this type of marriage are usually at a minimum. Cousin marriage is usually found among peoples who have few if any other institutions besides the family, or among those in whom the family is the strongest institution in terms of frequency of interaction. In other words, in "strong" families, where almost all interaction is within the family, it is necessary to stabilize family equilibrium by marriage within the system. Among people like ourselves, who spend much of our time interacting in other institutions, marriage outside the family causes little serious disturbance. The shocks are compensated for elsewhere. In many cases, less upset of equilibrium results if we marry someone whose general position in institutions is like our own. Such a person may not be found within the family, if its members occupy varied positions in different institutions. In other words, we seek a wife from the same economic and educational institutions as our own, someone with similar tastes, similar background, and similar experience, which a cousin may not have.

Anthropologists customarily divide all first cousins into two classes,

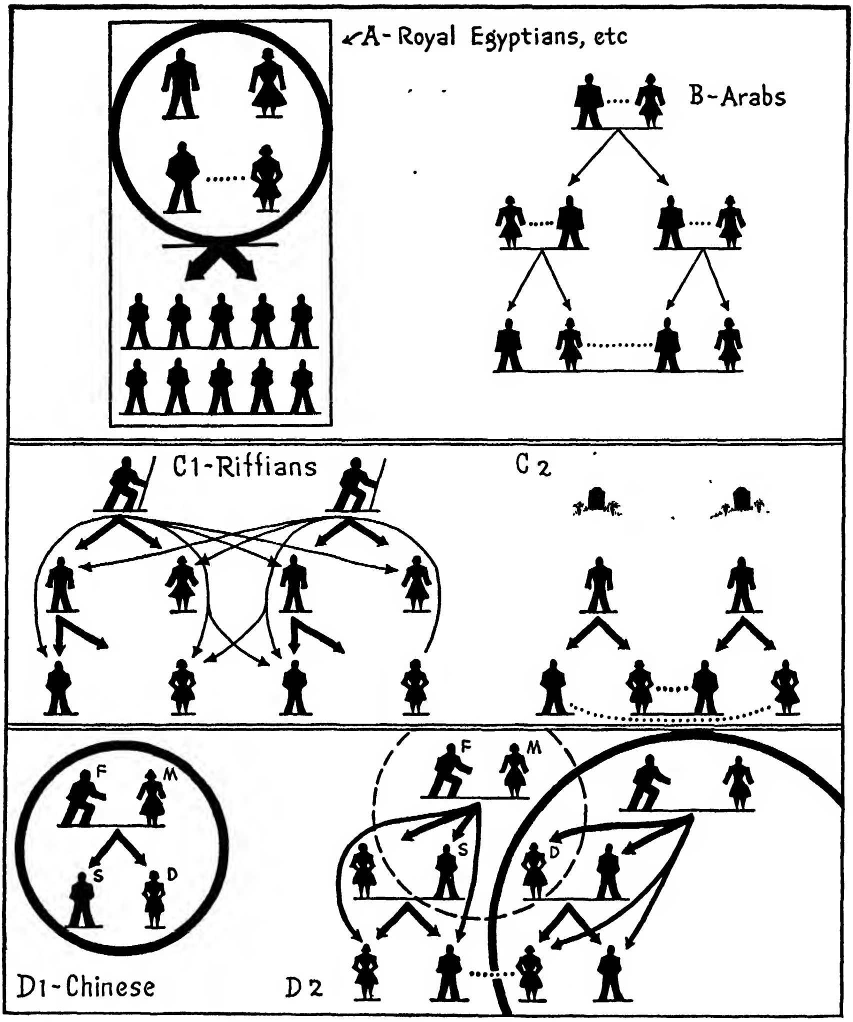


FIG. 5. TYPES OF PREFERENTIAL MATING IN DIFFERENT FAMILY SYSTEMS.

In preferential mating two individuals cannot marry if they are both termini in set events in the same set. In family systems which are strongly isolated, marriage between members of the family who meet the above requirements causes less disturbance of equilibrium than marriage outside. The four types of family illustrated all have in common a high degree of isolation as systems, and the different types of preferential mating which result are a function of the frequency of set events and of membership in the several parental sets. It will be seen that there is a definite progression from the brother-sister marriage of the Royal Egyptians to the cross-cousin marriage of the Chinese in terms of the quantitative values of the parental set.

For key to symbols, see Figure 3b, page 284.

parallel cousins and *cross cousins.* Parallel cousins are children of siblings (a term describing brothers and sisters regardless of sex) of the same sex; i.e., the children of two brothers or two sisters. Cross cousins are children of siblings of opposite sexes; i.e., of a brother and a sister. Thus the children of two sisters are parallel cousins, and so are the children of two brothers; but the children of a brother and a sister are cross cousins.

Parallel Cousins. The marriage of parallel cousins is a relatively rare phenomenon. It occurs when the interaction within the family system is much stronger than that outside it, and when either the male or the female set, is also very strong. Another prerequisite of this type of marriage is that the parental set be reduced to the minimum necessary for training children.

The best example of parallel-cousin marriage known is that of the Arabs, among whom the male set outweighs all others in relative frequency. The world of camel nomads is a man's world, as we have already seen in Chapter 9; the techniques which these people practice in adjusting to their environment require a high rate of origins from males to females. Thus when two brothers have children, the son of one will ordinarily marry the daughter of the other (see Figure 6). The male parallel cousin is called *ibn el 'am,* or *son of the paternal uncle;* his prospective wife *bint el 'am,* or *daughter of the paternal uncle.* The *ibn el 'am* has the *right* to marry his cousin; frequently he will. But all families do not have equal numbers of boys and girls, and hence this does not always work out the way it should ideally. In such cases the *ibn el 'am,* rather than the girl's father, is the one who has the right to say whom the girl shall marry. If there is no person in the position of *ibn el 'am* to her, this office will fall to a paternal second cousin. The key to this type of marriage is to be found in the strong relation between individuals who are members of the same class in the male set, which in this case means father, son, and paternal uncle. If the son should terminate as son-in-law to a person other than his paternal uncle, that is, to someone outside this class, these relations would be disturbed and the routine techniques of camel-herding and fighting would be interfered with, thus endangering the family system.

Among Arabs, the males originate to the females at a high frequency, and the females, as a class of termini in set events, respond to them. Thus the habitual pattern of relations which is established in childhood between the *ibn el 'am* and the *bint el 'am* can be carried over in the marital relationship with a minimum of disturbance of equilibrium to the individuals and families concerned. From the standpoint of adjustment, then, this is the most economical type of marriage possible in this particular society, and

hence the one which is considered ideal and which is practiced when other considerations make it possible. The *ibn el 'am* cannot marry his sister because they both terminate to the same parents; he can, however, marry his *bint el 'am* because the set in which he and she terminate to the origins of their mutual grandparents is not strong enough to draw them too closely together, since the frequency of origins in the parental set is low in general. It is high enough to prevent brother-sister marriage, as in the case of the Egyptians and Azande, but not that of those one generation further removed.

The Riffian System. If in a type of family organization essentially similar to that of the Arabs, the frequency of the parental set increases, a different type of marriage results. This is best illustrated by the system in use among the Riffians. Here the extended family consists of a number of related families descended in the male line from a single ancestor. Within this group, which is called the *bone,* are a number of segments called *veins,* and each vein consists of a generation of brothers, forming Class A in the set, with their wives, sons and unmarried daughters, through as many generations as are living. As long as one of the brothers who belongs to Class A is still alive, no one in the younger generation can marry any other member of the same class of termini. But as soon as the last old man has died, the vein splits into its component elements on the next generation level and marriage between the new veins so created can take place, providing that they are not between paternal first cousins; the Riffians look on the Arabs in contempt for this practice.

The difference between the Riffian system and that of the Arabs derives from the different frequencies of interaction in sets. Among the Riffians, the parental set is strong as well as the male set, since the oldest living generation has authority over the younger people. This makes all of the Class C group, who are usually first cousins, termini to the origins of the old people. Now if two members of this terminal class were to marry, that is, to enter into a relationship in which they would originate and respond to each other with a high frequency, they would naturally respond much less to the origins of the older people than before. If the high frequency of the parental set is to be maintained in such a system, marriages of this kind cannot occur, and the individuals are conditioned from childhood against too high an interaction rate between males and females in the terminal group. This is the reason for many of the "rules of avoidance" which we shall discuss presently. In a system like that of the Riffians, first cousins occupy similar positions to those of a brother and sister in a unit family, who cannot marry for the same reason.

If the equilibrium of the family system is to be maintained at its accustomed level, the brother-sister relationship, and in the Riffian example the cousin relationship as well, has to remain at a constant frequency. If this frequency begins to increase a disturbance results, and this is compensated for by increased origins of action in set events on the part of the parents. In other words, if the children show too much interest in each other, the parents rebuff them. This is a purely automatic action; any reasons which the parents give for it are likely to be rationalizations.

Cross-Cousin Marriage. In the Riffian system as opposed to that of the Arabs, the relatively high frequency of interaction in the parental set makes parallel-cousin marriage impossible. This system merely determines who shall *not* marry, rather than who shall; within the larger unit of the bone, the individuals have free choice beyond these prescribed limitations. Hence in the case of each marriage there must be an individual adjustment between the unit families. Since, however, they all interact at a high frequency within the bone, this adjustment does not involve serious changes in the equilibrium of the two unit families, and it makes no difference which of these families are thus united.

There are conditions, however, under which individuals must be selected from specific families for marriage in order to create the least possible disturbance of equilibrium in each of them. In some societies there are no large, expanded families like the Riffian bone, in which the unit families are already well adjusted; in others, these large units exist, but the parental set is so strong that all of the members of the younger generation act as termini to the origins of the older generation, and a marriage between any two individuals within the larger unit would disturb its equilibrium.

It is under such conditions as those described above that cross-cousin marriage arises. Let us take, for example, the Chinese family as described by Dr. Fei.[2] Here the parental and male sets are both strong and a group of brothers, or one old man, stand at the top of the set in the Class A position, with their wives, sons, unmarried daughters, and so on, exactly as in the Riffian vein. The difference is, however, that in the Chinese family the parental and male sets are both stronger than in the Riffian family, and the Chinese clan, which is a large unit comparable in size to the Riffian bone, itself becomes an incest group, which is the largest unit within which adjustments can easily be made.

In the Chinese system, the practice is for a young man to marry his father's sister's daughter. Since his father's sister has left the family on marriage, she no longer responds to the origins of the head or heads of the

[2] Fei, H. T., *Peasant Life in China,* London, 1939.

family; nor do her daughters; hence these women are no longer members of the same terminal group as their male cross cousins. This kind of marriage, therefore, would create no disturbance which either family system could not easily take care of. Furthermore, the advance knowledge that marriage between these two individuals is to take place makes it possible for the two families to interact on this basis during a rather lengthy period of betrothal, and so prepare themselves for the change; moreover the already existing interaction rate between brother and sister, resulting from their earlier relations in one family, makes it easier for the two families to adjust than if they were strangers.

The point about cross-cousin marriage is that it provides a regular system of exchange between families, and once it has begun to operate, it becomes habitual and automatic, so that it is difficult for an individual to avoid it if any cross-cousin is available; even if there is not, some substitution will be made from the ranks of more distant cousins, so that in the long run the score will come out even, and equilibrium will be preserved.

Extensions of Cross-Cousin Marriage. Among some peoples the cross-cousin marriage system is extended from first to second cousins, and even beyond, as the parental set increases. For example, in many Australian tribes the people live in bands of fifty to a hundred individuals, which include a Class A of older males, all related to each other in the male line, and their wives, sons, unmarried daughters, sons' wives, grandsons, and so on. Each band is exogamous; as in the Chinese system, girls cease to terminate to the origins of their fathers, paternal uncles, grandfathers, etc., in the parental set once they have married and changed their residence. Therefore marriage habitually takes place between cross-cousins belonging to different bands.

In tribes where this cross-cousin marriage takes place, the technique of marriage is usually referred to as a two-class or two-group system. In other tribes, however, the age set has a high frequency, so that each band is divided into age-graded sections. Since neighboring bands which habitually intermarry meet at regular intervals, the members of a younger age grade will terminate in set events in the age set to older members of a neighboring band. As a result young men of one band will be unable to marry girls of their own age grade in the neighboring band, since these girls will be co-termini with them in the same set. Hence men frequently marry women younger than themselves, or else women of bands distant enough so that this age restriction will not apply. Since the cross-cousin marriage system is also in force, there will be more women who are suitable for marriage in the class of second cousins than in that of first cousins. Obviously, a man

will have more second than first cousins who are of a different age or who live in a relatively distant band territory.

In an Australian band, which is a closely-knit unit in every respect, all males of a given age grade consider each other as brothers, and hence all men of their father's generations as uncles. Hence all uncles' daughters are regarded as cousins, and a man can marry any female cross-cousin, except for the restrictions imposed by the age set. Where the age set is weak one finds the so-called two class marriage system, in which all women of one's own generation are either sisters, and hence ineligible for marriage, or cousins, and hence eligible. Where the age set is strong a distinction is made between first-cousins, who are ineligible, and second cousins, who can be married, and a four-class system arises. In the center of Australia, some tribes even have eight and others sixteen class systems. It may be interesting to note that the simpler type of cross-cousin marriage is found in the parts of Australia where food is relatively abundant and the bands do not have to cover much territory in their seasonal rounds; neighboring bands are close enough to each other to permit the necessary interaction. The complex systems have arisen in the deserts of Central and Western Australia where food is very scarce; the bands are small and cover wide territories, and the maximum effort is made to build up interaction between bands, since a failure of one band to obtain food may necessitate their dependence on another. In other words, sharing, as defined in Chapter 11, needs to be more extensive in the lean lands than in the fat, and the mechanism for sharing is built up through a high frequency of interaction in the family institution.

Male and Female Sets in Cross-Cousin Marriage. In cross-cousin marriage, some peoples show a preference for the daughter of the father's sister rather than that of the mother's brother, or the reverse. This depends on the relative frequencies of interaction in the male and female sets. Among the Vedda of Ceylon, who practice cross-cousin marriage, a young man marries his mother's brother's daughter if such a person is available, and goes to live with his wife's parents in their cave. He hunts with his father-in-law, and inherits from him the rights to special hunting places, and cliffs and trees where wild bees nest. In the Vedda family the female set is stronger than the male set, since the wife's family interacts with the couple more than does the husband's. It is not surprising, therefore, to find the couple living with the wife's family, nor to find one type of cross-cousin marriage, that of a young man with his mother's brother's daughter, preferred, since his maternal uncle usually *is* his mother's brother if the marriage system has worked out ideally for two generations.

Among the Chinese, as described by Dr. Fei, where the male set is

stronger in frequency than the female set, a girl who is married to her father's sister's son is called "Girl Going Up the Hill," and this implies that the family will be prosperous, or that the marriage has been felicitous. A girl who is married to the opposite cross cousin, that is, to her mother's brother's son, is called "Girl Going Back to the Native Place," which is supposed to imply the ruin of the family.

Marriages Outside the Family. Although marriages between individuals who recognize some kind of kinship are widespread, there are, as we have stated, peoples who do not ordinarily marry kindred, or at least individuals whom they recognize as such. Even among peoples who ordinarily do practice some kind of cross-cousin or parallel-cousin marriage, there are always individuals who cannot obtain a wife in these ways and have to go outside the group for a mate. One technique, which has been greatly overemphasized in many ethnographic accounts, is to capture a wife from some other group.

Among the Ona, this is a fairly common practice. A young man who wishes a wife and cannot obtain one in his own band may creep over the crest of his people's hunting territory and search for stragglers among the womenfolk walking from one camp to another in the next valley. If he finds a young woman alone, he may threaten her with his bow and arrows, and force her to march over the crest into his own valley, where she is forcibly kept as his wife until she becomes conditioned to the new group and remains voluntarily. This custom has also been reported from Tikopia where it is practiced by Polynesians, from the Ifugao of the Philippines, and elsewhere. Among many other peoples, the act of capturing the woman is acted out dramatically as part of the wedding ceremony, for purely symbolic reasons, as we will see in Chapter 20.

Among people who have developed high frequencies of interaction in non-familial institutions, it is usual to take a bride from these institutions. In Southern Arabia, for example, where artisan castes among the city populations are strongly developed, a tanner will marry a tanner's daughter, an oil-seller an oil-seller's daughter, and so on. This principle is carried to extremes in India and in some of the tribes of the Sudan where occupational caste systems are highly developed. In our own society, as stated previously, the average individual belongs to many interrelated institutions and the choice of a mate is dictated chiefly by the general position of the individuals concerned in the totality of institutions, as will be explained in more detail in Chapter 17. A marriage with a person of the same religious affiliation, education, economic background, and so forth, will normally cause less disturbance to the equilibrium of the families concerned than any other

kind. Moreover, it will be the most common type because people who are thus equated will have the most opportunities to see each other.

Levirate and Sororate. The close relationship which exists in many societies between brother and brother due to the high frequency of the parental set, or between sister and sister, not only brings about regulations to limit the marriage of their children, as we have seen in the case of cross-cousin marriage, but also serves to define the marital relationships in cases where the individual takes more than one spouse. Two of its results are the *levirate* and the *sororate.*

The levirate is the practice by which a man inherits his brother's wife or wives, or in which one brother gives a wife to another. Usually it is the older brother who bequeaths or gives the wife or wives to a younger brother. This special form of levirate is called the *junior levirate,* and is the result of the fact that the older-to-younger set is normally stronger in any society than the younger-to-older. Among the Riffians, for example, the junior levirate is extremely common, owing to the prevalence of feuds in which the majority of the adult males are killed off before they reach middle age. Hence a young man who marries may soon find himself responsible for two or three other wives whom he has inherited from his brothers, and the majority of men over thirty years of age in some of the more warlike districts have two or more wives. In some societies where the age set is strong, the older men marry most of the young women, and an older brother will give a wife to a younger brother. This has been observed among some tribes in Australia.

The sororate occurs when a man marries two or more sisters. In some cases he marries them both at once, but more often his wife's family gives him a second wife when the first has died or failed to produce children. Both the levirate and sororate serve to maintain the equilibrium between the two families which has developed after the marriage of their children.

Since ordinarily the relation of a husband's kin to his wife's kin involves an orderly interaction in which gifts, feasts, or outright payment is made, the death of a man or of a woman, or the barrenness of a woman would require a readjustment which might have far-reaching consequences in other systems. In the Rif, for example, the widow of a slain warrior would have no one to support her and her children if her husband's brother did not take charge. Her husband's family may have paid as much as a thousand dollars for her, and all of the members of the extended family, including as many as twenty or thirty unit families, may have helped contribute this sum. She must continue to live with them and bear and bring up children, particularly boys to replace the men killed in battle. By the substitution of the hus-

band's brother for the husband, i.e., a person who occupies approximately the same place at the juxtaposition of parental and male and female sets the disturbance caused by her husband's death is reduced to a minimum.

Polygyny and Polyandry. Out of situations like this, in which the sex-ratio is disturbed, arise many cases of polygyny, or the marriage of one man to a number of women. In some societies, in which the sex ratio is normal, the wealthy or politically powerful practice it, while the poor or politically insignificant males may have to wait a long while before they can obtain a wife. As we shall see in the next chapter, in many tribes of Negro Africa important men obtain many wives, who produce an abundance of food which the husband may distribute among his followers to maintain his leadership. At the same time his marriage with women of different families or tribes increases his interaction with the groups from which these women are obtained.

Polyandry, or the marriage of several men to one woman, is found in societies where the levirate occurs and where the men outnumber the women because of female infanticide, that is, the killing of some of the female children at birth. It is, therefore, of the fraternal type, in which two or more brothers marry a single woman. In such a case the children are attributed to one of the brothers.

The reason why the normal marital state is monogamy, aside from the fact that at the age of marriage in most societies the number of males and females is approximately equal, is that marriage brings about the extension of male and female sets to the kin related through marriage. The development of sets in which different families occupy terminal positions involves differing stresses in the interaction of the members. Few polygamous (a term which includes both polygyny and polyandry) households maintain a constant equilibrium. Everyone who has observed the interaction within such an establishment knows that there is usually much conflict and constant intrigue incited by the women's families, and that is why polygynists either marry sisters, who are adjusted to each other before marriage, or keep their wives in separate houses. It is also a reason why polyandry is almost always fraternal. In any polygynous household there is always a head wife; in the case of polyandry, one brother, usually the oldest, is the leader. Polygyny only occurs in societies where the male set is strong and in which a male can originate to his wives in set events and hope to keep some measure of peace.

Rules of Familiarity and Avoidance. If family systems are to remain in a state of equilibrium, not only must members interact at constant rates, but their relations to certain relatives who are either potential spouses or

potential sources of disturbance need to be clearly defined. In these cases, the requirements of the system are such that abnormal rates of interaction are enjoined upon the individuals occupying the relation by the others in the group. No rational procedures are involved. The individuals merely *feel,* because of the operation of the interaction upon them, that such and such behavior is suitable to the relationship. These relations include those between a young man and his maternal uncle, a man and his mother-in-law, a man and his wife's younger sister, and many others.

Privileged Familiarity. In a society in which the levirate is practiced, a younger brother is allowed much familiarity with his older brother's wife. He can converse with her frequently and intimately, he can joke with her about subjects which he would not dare mention to other people, and in many cases he is allowed to have sexual relations with her while his older brother is away. An Australian, whose choice of a wife is restricted, may have sexual relations with any woman in the class into which he is allowed to marry, and he is expected to let any member of his own marriage class have intercourse with his wife upon request. Thus a man and a woman who may some day become husband and wife maintain a high interaction rate and condition themselves to this potential relationship.

Another relationship which often becomes very intimate is that between a young man and his mother's brother, particularly in societies where the boy is brought up in his mother's family's household. In Melanesia, boys are allowed to steal from their maternal uncles' gardens without being punished. Among the Hopi it is not uncommon for a young man to have sexual relations with his maternal uncle's wife. In these societies, it will be remembered that the maternal uncle is the disciplinary agent.

This compensatory tendency involves wider circles of relations in cases where the extended kin are organized. Here they provide a channel for interaction between members of sets which would otherwise be submerged, and thus they serve as a counterbalance to the dominant set. Professor Lowie, who first recognized the "joking relationship" and pointed out its significance, shows how among the Crow, who are organized in female clans, the father's clan is given some importance by this mechanism.

Individuals who have this joking relationship with each other are called ī'watkusū'a, or joking-relatives. These are people "who would be of the same clan if descent were paternal."[3]

[3] Lowie, Robert H., *The Crow Indians,* Farrar & Rinehart, New York, 1935, pp. 22-23. See also Radcliffe-Brown, A., "On Joking Relationships," *Africa,* Vol. 13, No. 1, 1940.

There were two aspects to this relationship, a comic and a serious. On the one hand, ī'watkusū'a were allowed to play practical jokes with impunity. For instance, if a man recognized a wagon outside a house as his joking-relative's, the fancy might seize him to reverse front and rear wheels. Under ordinary circumstances the owner would show resentment, but not as soon as he discovers the identity of the joker: then he must not get angry, but merely bides his chances for getting even.

One [joking-relative] might mock another who had made himself ridiculous. A certain good-looking young man married an old maid. Fire-weasel's wife, a joking-relative, then berated him: "You had better marry a frog or a mouse or some other animal than an old maid. What is an old maid good for?" The man did not reply but sat there laughing. . . . A man would tell a woman, "You are crazy, you are lecherous," and she might reply in kind. To a woman one said such things as: "You are not good enough to attract any man"; "You have never put up a tent," . . . "You are exceedingly lazy, you never do any beadwork or make moccasions for your husband."

Most significantly, the joking-relatives are a person's privileged mentors and censors when he has performed some veritably objectionable deed. In contrast to his own clan, whose function it is to shield him from social obloquy, the joking-relatives deliberately try to make a man ashamed by publicly jeering him and twitting him with his improper conduct. From others such mockery or rebuke would be an impertinence.

Needless to say, the amount of interaction which takes place between individuals in a set, or in two systems, is what is important here, and the form which the interaction takes is not qualitatively important. Playing jokes on each other and making fun of each other to their faces are merely intensified ways of originating action, which are sure to get a response from individuals who, through their membership in other systems, might not otherwise reciprocate.

Rules of Avoidance. Rules of avoidance are automatic mechanisms for keeping the interaction rate low between individuals who would upset the rate of the predominant sets if they were to interact together with too great a frequency. As we have seen, in any society in which the parental set is of normal strength, brother and sister cannot marry, and if interaction within the parental set is increased in frequency, parallel cousins also cannot marry. In most societies, there are rules of propriety which prevent too much familiarity between brother and sister. In our own, for example, boys do not ordinarily speak of intimate affairs with their sisters as they would with girls whom they were engaged to marry. A Riffian also avoids intimate conversation with his parallel cousin, although he talks freely with his brother's wife.

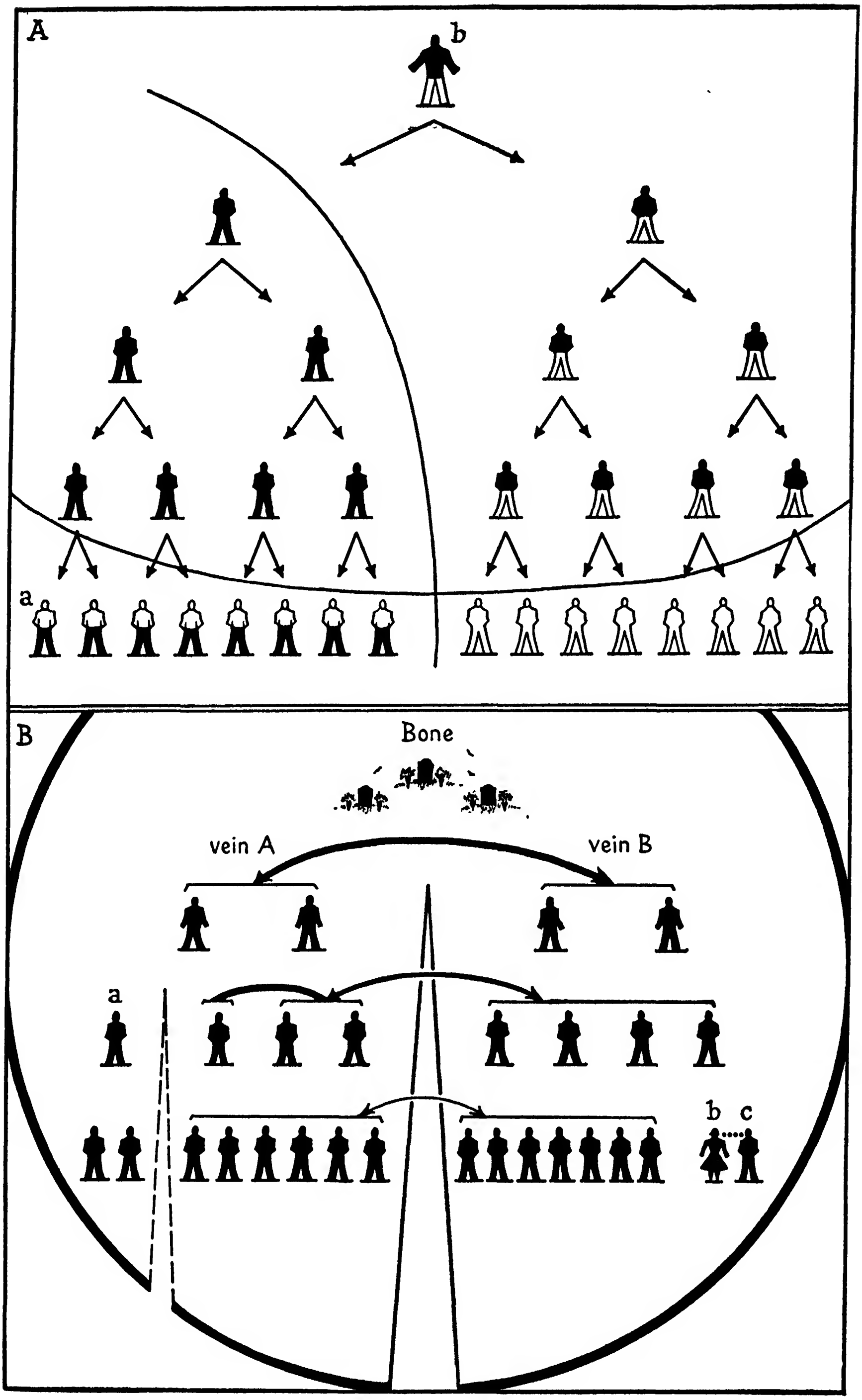
The commonest of all rules of avoidance is the so-called "mother-in-law" tabu, which limits the interaction between a married man and his wife's mother to a minimum. Among the Vedda, for example, when a man approaches the cave where he lives with his wife and her parents, he will shout before he gets there so that his mother-in-law will know that he is coming and prepare to act accordingly. He sits on his own section of the cave floor, and does not speak to his mother-in-law, nor does he accept food or anything else from her hand. Only when his wife or father-in-law, or some other third person, is present can he speak to her, and then he must do it by oblique reference through an "interpreter." If his mother-in-law wishes to give him food, she will first hand it to her daughter or husband.

Among the Vedda, as among other people who practice the mother-in-law tabu, the mother-in-law ordinarily originates at a high frequency to her daughter, and the son-in-law also originates to his wife and his wife to him in their marital relationship. There is thus a potential conflict, owing to the overlapping of the parental and male sets, which is avoided by reduction of interaction between son-in-law and mother-in-law. In other words, you cannot place two people in the position of termini who originate to each other. Thus the son-in-law cannot originate to his mother-in-law and wife at once as members of Class C in the male set, nor can the mother-in-law originate to the wife and son-in-law in the parental set. So basic is this fundamental conflict that they cannot even interact in pair events when alone together.

The mother-in-law tabu is usually unnecessary when the two individuals concerned do not live together, since they do not have the opportunity to interact enough to cause this conflict. Where the bride is brought to the house of her husband's parents, a restriction may arise between her and her father-in-law, for the same reasons. One or the other of these tabus is found where the parental set and either the male or female set are both of high frequency. In our society the parental set has a moderately high relative frequency, but neither the male nor female set is particularly strong, and furthermore we do not ordinarily live with our in-laws. For these various reasons we have no such rule of avoidance, but nevertheless the mother-in-law problem is a serious one, and the mother-in-law joke is one of our favorite forms of humor.

III. EXTENSIONS OF THE FAMILY

The unit family, parents and children, is the smallest group to which the family institution may be reduced. All human beings normally have other family relationships, however; a married man has his parents, and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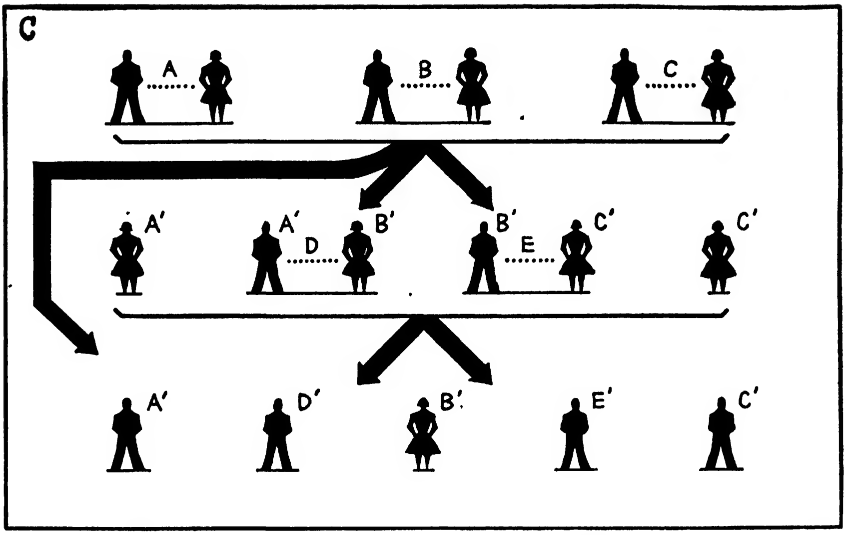


Fig. 6. Types of Extended Families

(A) The 'Ahl or Kindred. In societies where extended families are found, the forms which these take depend on the relative frequency of events in the various sets. Among the Arabs, as we have seen in Figures 4 and 5b, the male set is strong and the parental set weak. Man (a) reckons as his 'ahl-mates or kindred all persons descended from a mutual ancestor in the male line no more than three generations away, because in an isolated system of this kind interaction is limited to three generations. In the descending line this relationship includes likewise only three generations away from any living individual. The figures with their lower parts solid are in 'ahl with (a), those with the upper parts solid with (b), those which are completely solid with both.

(B) The Riffian Clan (Bone). In this case the parental set is stronger and the male set weaker. In a Riffian *bone* or clan the oldest living groups of brothers form the heads of the separate *veins* or lineages. The veins are held together in the bone by the extension of the parental set by which brothers originate to their nephews, and by the requirements for interaction in set events in Riffian technology. In this example man (a) and his sons have moved up the valley and founded a new village. When his descendants shall have lost their incest restrictions with the others, they will form a clan of their own. Woman (b) has married a stranger (c) adopted into the bone; their descendants will eventually form a separate vein.

(C) An Andamanese Band. In Andamanese society the age set has by far the highest frequency, and older persons originate to younger without regard for family lines. The reason is that the Andamanese live in very small groups and families share habitually with one another. The three age-grades shown are elders, young adults, and uninitiated children. Letters over the marriage symbol denote couples, letters with strokes their offspring.

his wife has hers; there may be any number of brothers, sisters, cousins, and the like, of whose existence both of them are aware. Any married person, therefore, may interact in two or more unit families.

Marriage is fundamental to the development of extensions of the family. If the parental set is strong, so that the sons bring their wives, or the daughter their husbands, home to live under the parental roof and subject to parental authority, the unit families which are linked in this way are so closely associated, that is, their members interact with such frequency, that they become a single institution. The sets become extended, and the frequency of set events in this extended family is high enough to keep it together.

There are two directions in which the unit family may be extended; vertically and laterally. A family may be said to be extended vertically when it includes at least three generations. It is extended laterally when it includes individuals of the same generation who have no living common ancestor. No group exists which extends laterally only; the lateral extension is merely the retention of kinship relations by members of the B and C classes in the parental set after the members of the A class have died.

The Lineage. The most simply organized peoples of whom we know do not have extended families. The Bushmen, the Andamanese, and the Punans, for example, live in bands of unit families which gather food in unison and share their products. The band is a unit in which the frequency of interaction between unit families is high and ordinarily equal, and no mechanism is needed to provide for the selection of mates within it. Neither the parental set nor the male-female set has an especially high relative frequency.

If, however, we increase either the male or the female set, without greatly increasing the parental, we find a situation like that among the Arabs, whose marriage system we have already studied. In their case the extended family unit, which comes next above the simple family, is the so-called *'ahl,* or *lineage.* This can be best explained by reference to Figure 6. Two Arabs, A and B, are not sure whether or not they belong to the same *'ahl.* They sit down and name their fathers, grandfathers, and so on until they have found a mutual ancestor in the male line. Then A counts on his fingers the number of individuals between himself and B; his own father will be number 1, his grandfather number 2, his great-grandfather number 3. Now if this great-grandfather was the common ancestor, he will then count his grandfather's brother, who was B's grandfather, as number 4. Number 5 is A's grandfather's brother's son, and at the same time B's father. Thus there are five individuals between A and B, the maximum number permissible if these

men are to be in the same *'ahl*. If there were 1, 2, 3, or 4, they would still be *'ahl*-mates; if 6, they would not. This system of reckoning results from the fact that a group of male kindred who take part in the habitual activities of herding, warfare, etc., ordinarily include but three generations of men who have been terminating to a common ancestor, their great-grandfather, or to the group of brothers who form the next generation immediately below him.

It is clear that the *'ahl,* or lineage, is not a mutually exclusive group. A given individual will be in *'ahl* with a number of people who are not in *'ahl* with each other. The *'ahl* is a group of individuals who hold themselves responsible for each other. If one commits a murder, all of his *'ahl*-mates are responsible; if someone kills him, all of his *'ahl*-mates have the duty of exacting vengeance. In marriage, the *ibn el 'am* must always be found within the *'ahl,* even if there is no parallel cousin available.

An *'ahl,* therefore, is a group of individuals who might be expected to interact with each other with sufficient frequency to form a kind of family institution. The techniques of nomadic life and the contests for pasture and water in years of drought provide a strong enough external disturbance to make this interaction necessary. The *'ahl* itself is not coterminous with the band. The latter is composed of a number of individuals who are related to each other by a number of interlocking *'ahls,* or lineages, much like our in-laws. While the interaction between *'ahl*-members is high, that between non-*'ahl* members in the same band is lower. This results from the fact that the male set, as we have seen, is of high frequency and the female low. In the *'ahl,* Class A in the male set is composed of a group of related males; Class C of their daughters, sisters and mothers. When a married woman gets into trouble, it is not her husband or his *'ahl* but the members of her own *'ahl* who are responsible for her just as they are for one another.

The *'ahl* is not, obviously, synonymous with a band; among the Arabs the band is composed of a number of unit families between and within which there are many different *'ahl* relationships. All of the members of a band, however, usually trace their descent to a more distant ancestor and thus form part of a larger kinship institution, of which we shall speak later.

Lineages of this type are not limited to the Arabs, nor are all of them traced on the male side. In some of the Northwest Coast tribes, the Indians recognize female lineages, to which the people living together in the same sedentary village usually belong. A number of conditions, concerned with environment, technology, and other institutions, can produce the combination of a low parental set frequency with a high male or female set frequency, which in turn produces the lineage.

The Clan. If, in response to environmental or technological change, a system like that of the Arabs should increase its parental set, a clan of the Riffian type would result. We have already seen how such a change would affect the choice of a mate in marriage; we are now concerned with the difference which it would make in the extended kinship group as a whole.

The Riffian vein, previously described, is a group of individuals who terminate to the origins of a Class A of brothers who occupy the oldest generation level in the parental set. A vein differs from an *'ahl* in that its membership is mutually exclusive; a given individual cannot belong to more than one vein at a time. In the *'ahl,* the individual can belong to several, for while membership is also determined by descent from a common ancestor, the frequency of events is much lower, and no single group tends to segregate itself out and become isolated from the others. No particular ancestor serves as a fixed point in this process.

The Riffian bone is a laterally extended kinship group in which the parental set is strong enough to prevent marriage within the vein, but not within the bone itself. The geographical isolation of the Riffians in narrow valleys, their need for cooperative action in maintaining irrigation ditches, operating olive presses, etc., provide the background for the development of an extended kinship group such as the bone.

In the terminology of anthropology, an extended kinship group without designation of the male or female set is called a *sib;* a male sib is a *gens,* and a female sib a *clan.* In popular usage, however, and even in common usage among some anthropologists, the word *clan* takes the place of sib, and we may, therefore, speak of *male* and *female clans.* This terminology is useful for our purposes, because it refers to the dominant set within such a kinship group. The Riffian bone, therefore, is a *male clan,* while the Hopi clan is a *female clan,* and so on.

When the members of a clan marry each other, it is endogamous; if they marry outside, it is exogamous. *Endogamy* and *exogamy* are, therefore, relative conditions. Except for the special cases of the Azande, the Egyptians and the Inca, the unit family is exogamous. Most tribes or nations, including the United States, are endogamous, but there may be wide differences in the exogamy of the groups contained within them. The degree of exogamy is dependent, as we have seen, upon the extent and frequency of the parental set. The degree of endogamy is dependent upon the degree of isolation of the particular system involved. The members of the Riffian bone are confined within a narrow valley in which the technical requirements of getting a living impose much interaction between the members.

Similar degrees of isolation, for very different reasons, characterize all endogamous groups.

The distinguishing feature of the clan, however, is in just that degree of isolation. This results from the necessities of adjusting to the environment within the limits of certain techniques. In most anthropological works, distinctions are made between "strong" and "weak" clans. What is being referred to here is the degree to which the system of endogamous or exogamous kindred is isolated from other such groups. A scale can be made from the weakest clans to the strongest; it is a scale based upon the frequency of the interaction within the clan.

Primarily this "strength" is dependent upon the degree to which the clan leaders—the oldest effective males, that is, members of Class A in the parental set, Class A in the male set, and very often, notably in Polynesia, Class A in the age set—originate action through the necessities of the technical processes. In Tikopia,[4] for example, where a number of the techniques practiced involve the interaction of a number of people, as we saw in Part II, families, or households, are united patrilineally in what are called "houses" or "paito." These paito are then linked to one another in clans, each of which is headed by a chief. Every house and clan traces its ultimate origin to an individual family circle. The head of the paito is in theory the senior male descendant of the original ancestor. In the same way, the clans (kainanga) consist of individuals descended from a common ancestor, so that the groups form systems which are separate from those descended from other parent-child sets. Firth says that the elder of a paito acts toward the members of his kinship group in much the same way that the chief does to the clan. He organizes production for the group, acts as leader in many of their cooperative affairs, is dominant in deciding how to distribute their goods, and moreover, performs the ritual acts which unite the people with their gods. In this group, it should be noted, the chiefs of the clans are chiefs within the family institution, that is, they occupy a position by virtue of their position in the family sets, and not as members of an outside, nonfamily institution.

Moieties. When clans in a band, tribe, or other group are separated into two opposing halves, or sides, they are called *moieties* (halves). Among the Omaha there were two moieties, the Sky and Earth, of five clans each. Among the Galla of East Africa, the two moieties are called Left-Handed and Right-Handed; in California they are called by some tribes Up-Stream and Down-Stream, or Land and Water.

[4] Firth, R., *We, the Tikopia,* London, 1936.

In some tribes, moieties are exogamous, and regulate marriage; this is the case among some of the Northwest Coast tribes, particularly the Haida. In others their chief utility is to regulate interaction between two sides, or teams, in a village, tribe, or whatever, in any activity which requires this type of reciprocal or alternate action. Most frequently moieties are concerned with ritual and games, which require opposing "teams" and with which we shall deal later. Less often they are concerned with the techniques of getting a living. In many tribes, a moiety division will operate only during one season, when the activity with which it is concerned takes place, as, for example, among the Canella in Brazil,[5] who have rainy season moieties and dry season moieties, membership in which is differently inherited, to govern the games which take place during the rites held at these times of seasonal change.

In general, moieties stabilize the relations of scattered groups. By opposing one group of clans to another, they canalize the interaction between the moieties and thus increase interaction between the members of a moiety. Such divisions are very common in all societies, though they may not be inherited. Familiar examples are Town and Gown; East Side, West Side; Across the Railroad Tracks.

The Formation of Extended Family Groups. An extended family, such as a clan, can maintain its existence only so long as its members are able to interact with each other at a high enough frequency. When the clan has grown so large that the activities of its members prevent them from interacting above the minimum frequency required for this purpose, they divide or disintegrate. Among the Riffians, there are numerous instances in which a given clan has become so numerous that its members have had to spread out into several valleys, and have thus become economically as well as geographically independent. When this occurs, the inhabitants of each valley or portion of a valley inevitably form separate systems, and the new clans trace their descent to the ancestor who led them into the new country. Among the Tungus the same thing happens: when the members of a clan have become so numerous that they have to occupy too large a hunting territory, those who hunt in different parts of it are unable to see each other, and hence they split up with local groups and their leaders as nuclei. Here, however, the parental set is so strong that they forbid marriage between members of a parent and a filial clan; only after another such splitting has taken place, and there is an intermediate clan between them, can

[5] Nimuendaju, Curt, and Lowie, R. W., "The Dual Organizations of the Romko'-kamekra (Canella) of Northern Brazil," *American Anthropologist*, Vol. 39, No. 4, 1937, pp. 565-582.

a derivative clan mate with its parent (see Figure 6 for a Riffian example).

There are other forces, however, which produce a diminution of clan membership, and clan amalgamation. Among both the Riffians and the Tungus, if a clan has been defeated in war, or been reduced by some other agency, so that the remnant is too small to compete with other clans, the survivors will be adopted by another clan. In this way clans are forever growing and shrinking, splitting and being absorbed. These twin processes provide between them a continuous change of personnel. Even among peoples who have no extended families but live in bands, the same principle is true; among the Bushmen, the Eskimo, and the Andamanese, for example. Obtaining a living in the band is limited by the environment, but its size must remain relatively constant.

Maximum Extension of the Family: Tribe, Confederation, Nation. Among many peoples who are organized in extended families, the clan is the only institution of the group. This is usually due to extreme isolation and the virtual absence of trade. More often, however, the splitting of clans, which we have just observed, is not followed by a total cessation of interaction between them, and one often finds groups of related clans preserving formal relations which bind them into some kind of a larger unit, which is, in effect, a major extension of the family system.

The Hottentot, for example, are organized into male clans which are grouped into tribes, each of which claims a common ancestor. Although these clans may fight each other, they will also help each other against a common aggressor. From time to time the tribe meets as a whole, and on these occasions the clans are spatially arranged in the camping ground in such a way as to show that the original clan from which the others split is the senior; the first to split is the next in rank, and so on down to the most newly formed clan, which occupies the place of least importance. The entire Hottentot nation claims descent from one ancestor, but the interaction between the various tribes, which are not even spatially contiguous, in many cases, is so low that they do not use this connection in rationalizing their interaction, as in the case of clan connections with a single tribe.

Age Grading. So far we have concentrated on the differential values of the parental, male, and female sets in the production of different kinds of family institutions. The fourth set, however, the older-to-younger or age set, is also involved in a number of characteristic variant forms. The age set is based not on the relation between the parental and filial generations, but on that between the generations, that is, between older brother and younger brothers, older sister and younger sisters, and older sibling and younger siblings in general.

It is not easy for most Americans to visualize the action of this set, because most of us were brought up in small families in which the few children produced were born relatively close together. Among most "primitives," however, as among many Europeans, a woman will bear children over a period of twenty years or more, until either the menopause or some accident of childbirth puts an end to her period of fertility. In such cases the age difference between older and younger siblings is so great that the former often have much to do with the care and training of the latter. Where the frequency of interaction in the age set is high, we find the type of organization known as *age-grading.*

In an age-graded society, which may be a clan, a tribe, or a simple band, the older-to-younger relationship is usually extended from individual sets of siblings to whole classes of individuals who are roughly of the same age. Thus there is no biological limit to the number of possible classes, as in the case of the parental set. In many age-graded societies, the number of classes recognized may run to ten or over.

One of the simplest examples of age-grading is found among the Andamanese, who live in bands of unit families. Among them the parental set is extremely weak. Parents exchange their children frequently, so that each child as it approaches maturity has been fed and trained in a half dozen or more huts by an equal number of adult couples, and by the older children in each household. This custom of extensive fosterage is, of course, a mechanism by which the interaction between the unit families in the band is built up to a high frequency.

It is not, however, merely an extension of the parental set. The children, once they arrive at puberty, go to live in separate huts for the unmarried boys and girls, with the sexes spatially separated. They have to go through a series of puberty ceremonies in which they are deprived of different important foods in succession, and which we shall describe in some detail in Chapter 20. Then there is a class of young, unmarried men who do a large part of the hunting. When they bring back a wild pig, they roast the meat at a communal fireplace and distribute it among the married women, who boil it in small pieces before serving it to their families. Within the families, the choicer and tenderer cuts of the meat are given to the older people. In general, younger people obey and defer to those older than themselves, without especial regard to parent-child relationships. They also address their elders with honorific titles. The women, furthermore, have a series of names which they adopt as they go through the various age cycles.

In most of the Australian tribes, the age set also operates at a high frequency. The boys who are of roughly the same age, usually within two or

three years of each other, are initiated in groups, approximately every two or three years. The boys who go through the initiation together form a class, comparable to a high school or college class, and throughout life they retain this association with each other. Where a number of brothers are born at intervals of two or three years over a stretch of twenty years, groups of brothers may be found in as many as five or six different age classes, and only seldom will two brothers be in the same class. Older brothers will originate not only to their younger brothers, but also to all of their younger brothers' classmates.

The way that this set attains a high frequency is not difficult to discover. In Australia, a horde gets its living off a wide expanse of landscape, and it takes much training and experience before a boy knows where the kangaroos will be at a certain time of year, where he can get water in the dry season, how long it will take him to walk between one water hole and another, and so on. The techniques of hurling spears with the wommera, and throwing a boomerang into a flock of birds, also take much practice; indeed, a great deal more than shooting a rifle or a shotgun. A boy, therefore, goes through stages of competence. One turning-point is marked at the time when he is finally able to shift for himself, and this ability is tested during part of his initiation ceremony. He must also, however, be able to provide for others, and during his initiation he is forced not only to provide his own food but to kill only certain kinds, sexes, and ages of animals in doing so.

As he and his classmates grow older, they marry, produce children, become better and better hunters, and gradually arrive at an age where their chief utility is not providing food but advising and instructing those who are younger. The classes which they instruct will contain their own younger brothers as well as their sons and grandsons. It is the high frequency of the age set, as well as of the parental set among the Australians which produces horde exogamy.

Examples of age-graded societies could be multiplied greatly. The most elaborate systems, which would take too long to describe here, are probably those found in East Africa, among cattle-herding people like the Masai, and others who combine cattle-herding with agriculture, like the Galla, as well as among the buffalo-hunting Indians of the American Plains, particularly the Blackfoot. In every case there is some visible reason for this, derived from the environment and the technology of the people, or from other institutions. Often the people concerned are either hunters or pastoralists, performing techniques in which the age, vigor, and experience of the individuals are of vital importance. Very frequently they are warlike, and the warriors

are drawn from an age class in the early twenties, and are not allowed to marry until after they have passed this grade. The experience of the American draft board has also shown the superiority of young, unmarried men, under 27 years of age, as soldiers. Not only are their nervous reflexes quicker, but also they will respond in set events to the origins of older men who are officers. Older men are too slow, too highly conditioned in other techniques, and too accustomed to originate to others to be suitable. In a highly age-graded society like that of the Blackfoot or the Galla, no attempt would be made to force older men to respond to the origins of younger men; the age-grading system which carries through the entire life span of the individual, and in which everyone participates, provides an orderly routine which is of great military value.

Conclusion. In presenting an analysis of family institutions and in showing the way in which different types of families have developed, we may have given the impression that family systems among any people present a uniform appearance. A moment's reflection should convince the reader that such is not the case. The type of family which we have described for any particular group represents merely an average or, more precisely, the most frequently found type in a given society. So when we discuss the strongly paternal family type among the Chinese or the maternal family of the Iroquois, we do not mean to imply that all Chinese or all Iroquois families correspond exactly to the type we have presented.

Each family system of any group represents a complex equilibrium between its members, since a number of previously separated systems are joined together by marriage and have to develop a stable equilibrium. Not only does this depend upon the adjustment to the environment and, as we shall see in Chapter 17, to other institutions as well, but also, to a large extent, upon the personalities of the individual members of the family.

The equilibrium of an institution, whether a family or a state, depends upon the degree to which the individual is able to attain his own state of equilibrium within the limits imposed by the institutional system. If a man is unable to secure a satisfactory adjustment to his wife and is consequently in a disturbed state, the compensatory activity which he undertakes is to a large degree canalized by the structure of the family. The solution of his difficulty will depend upon the frequency of events in the constituent sets. His parents, who do not wish the stabilized relations with the wife's family upset by a divorce, may force him to remain with his wife; or he may be able to take a supplementary wife, obtain his equilibrium with her, and reduce his interaction with his first wife to a minimum.

In entering upon marriage, as song and story have recounted since the beginning of man's known history, a man may wish to marry a woman whose position is such that a serious disturbance of equilibrium in his family would result. She may be within the incest limits; her family may be related to others whose relations to the man's family are seriously disturbing. The changes in the interaction rates which such a marriage produces may bring profound modifications in their train. They may involve the disintegration of a family or the death of the person whose changed interaction rates brought about the disturbance.

Moreover, an individual may very often occupy a position within the family system itself to which he is unable to adjust within the limits of the family's equilibrium. A younger son in a family system which hands on the leadership of the family to the older son, may have a high origin rate and be unable to adjust to the need of responding to the origins of his brother. He may even develop a stable relationship with this brother and, through him, control the interactions of the family. More commonly, however, the instability of such a relationship causes disturbances and a profound modification of a family's structure.

These inabilities of individuals to attain a state of equilibrium within the requirements for equilibrium of the group may result, as we have seen in Chapter 4, in maladjustments of personality in the form of neuroses and psychoses. Instead of this, however, they may produce compensatory increases in other institutions where these are possible. We shall see something of how this operates in other chapters in Part III, particularly in Chapter 17. Individual variation caused by early conditioning may produce wide variations of structure in family systems. A person with a high origin rate and the other capacities of a leader may upset a matrilineal system and turn it into a patrilineal system; he may change the order of action and the frequencies of events in the parent-child set by seizing the initiative and originating events for the rest of the family, throwing over the leadership of his father; a woman in a patriarchal family system like that of the Chinese may dominate and run the family. All these changes cannot, however, be attained without disturbance, and the profundity of the disturbance depends upon the particular equilibrium of the family and its relationship to the rest of the society.

SUMMARY

Families are interrelated by marriage. When a man and woman marry the new relationship produces a disturbance in the equilibrium of the parent families in which the man and woman have been previously interacting at

more or less fixed rates, and now new rates have to be established. The severity of the disturbance depends on the relative degree of isolation of the families concerned.

In different societies different procedures are habitually followed as to the choice of a mate and as to the other techniques by which the parental families shall regain equilibrium. In each case the preferred type of marriage is that which will cause the least possible disturbance, and the development of these types is automatic. This type varies in terms of the technological activities of the people in reference to their particular environment.

In a few societies where the parental set is extremely weak or absent, and where the family occupies a position at the head of a strong political hierarchy, as with the Inca royal family, it may create the least disturbance for brother and sister to marry. Such conditions are extremely rare. Where the parental set is weak but the male-female set very strong, as among the Arabs, the marriage between the children of two brothers creates the least disturbance and is preferred; furthermore the birth of a son after the marriage finally restores the equilibrium of the system.

In societies where the parental set is especially strong the marriage of first cousins may be forbidden, since it disturbs the habitual rates of interaction from grandparents to children and grandchildren by reducing the response of the latter. In cases where the male or female set is strong as well as the parental, there will be a difference in frequency of interaction between grandparents and the offspring of male versus female children. Daughters, in the case of a strong male set, and sons, in the opposite instance, will, upon marriage, move outside the family system. Hence the development of cross-cousin marriage, a marriage to a cousin outside the family system, but within the range of habitual if reduced interaction. In our own society where the individual interacts in many institutions outside the family, the preferred choice of a mate is with a person whose general institutional status is approximately equal, so that here again the least possible disturbance will result.

Besides the biological family consisting of parents and children, many peoples interact in extended family institutions, such as clans and tribes, which in some cases form sovereign states. As in the case of the unit family, the form which an extended family assumes depends on the relative frequency of the sets of which it is composed, and these in turn vary in terms of the balance between environment and technology.

These extended families are ordinarily found where the parental sets are very strong, and where the techniques of exploiting the environment require

the cooperation of a number of individuals. However, where these techniques become even more complex and a division of labor arises, institutions outside the family appear and these extended families tend, under certain circumstances, to disappear, since the other institutions tend to take over the activities about which they were organized.

CHAPTER 14

Political Institutions

I. THE DEVELOPMENT OF SIMPLE FORMS OF POLITICAL AUTHORITY

Rudimentary Forms of Leadership. We have already shown how differences in interaction rates produce differences in the personalities of individuals. In all societies, individuals with different origin rates and capacities for response adjust themselves within the limits of the family institution; political institutions arise when these adjustments take place outside the circle of kindred as well, with the result that one individual will exercise authority over a group not limited to members of his family.

In small, informal groups, leadership ordinarily develops only when it is needed. We all know of situations in which a man steps out of the crowd and takes control in time of crisis. In a shipwreck, one of the men in a lifeboat may originate to his companions, rationing the water and biscuits and keeping order. Among a group of howler monkeys, in the same way, when danger threatens, one monkey will take the lead, shrilling and grimacing. The others stand their ground or retreat through the trees in response to his actions.

Among shipwrecked mariners and howler monkeys alike, when a crisis arises to disturb a group, the frequencies of interaction of the component individuals also increase. Ordinarily reserved people talk to total strangers in periods when the equilibrium of a group is disturbed by fire, earthquake, or other sudden catastrophe. At such times, individuals vary greatly in the degree to which their rates of origins in set events increase, and this, of course, reflects differences in the degree to which their sympathetic nervous systems respond to external stimuli. A person who can not only get his companions to respond in set events to his origins but who can also adjust his rate of interaction to theirs will become the leader of that particular group in that particular crisis.

If in a band of howler monkeys there are two adult males, each of which has a high rate of origins in set events, in time of crisis each originates to the group as a whole and tries to get it to respond only to him. A conflict soon

develops, and the two would-be leaders bare their teeth and scream at each other, grimacing and sometimes biting. Eventually one outshouts or outbites the other, or both; the loser then responds to the origins of the winner along with the others, or else he slinks away with a few loyal followers. Similarly in a lifeboat there may be rivals with similar ability to originate at high frequency in time of crisis. Here too arguments will occur, and the one who wins will be the one who forces his rival to respond in unison with the others in the boat. Leadership, therefore, not only involves the ability to originate in set events; it also requires a capacity to act continuously until everyone else is silent.

Thus a leader is said to have control over his group when the interaction in set events is synchronized: an action on his part is followed by responses from all in the group. If one or more individuals interrupt him and outact him, they will upset his leadership and may finally secure it for themselves. The conflict of rival leaders will continue then until one forces the other to terminate to him, or removes him, by killing if necessary, as a dissident element in the group. Synchronization in the interaction rates of leaders and followers is just as important as in the case of two persons. To accomplish this, a leader must be capable of sustained action until *all* the others respond; that is why many great leaders are capable of "terrible rages," if they are crossed, i.e., do not obtain the proper responses.

Men who have the physiological advantage of an elastic origin rate which rises rapidly in a crisis usually encounter more than one such stimulating situation. A leader is a person who has formed the habit of originating action in set events and to whom others have formed the habit of responding.

Informal leadership, such as described above, is distinguished by irregularity of origins and by low frequency of interaction. It can only be differentiated from permanent leadership on a quantitative scale. If a group of people are to have a permanent leader, his relations to his followers have to be continually reinforced by origins of action, so that the conditioned habit of response may not become extinct. If he fails to do this, on account of illness, travel, etc., which decreases his usual interaction, his hold over his followers will be weakened, and if this continues long enough, it will be lost. To prevent another person from building up a following, replacing his own, a leader usually gets rid of rivals whenever possible.

In simple aggregations of human beings like the people in the lifeboat, the moment a leader arises and begins to originate to a group, a simple institution arises. In the case of a band of hunters or food-collectors, such as the Eskimo, Andamanese, and Bushmen, there is no political institution

under ordinary conditions, but once a disturbance arises and someone takes the leadership for the duration of the crisis, the band becomes, momentarily, a political institution.

More permanent political institutions develop only when the need for leadership becomes constant, rather than intermittent, and only in those cases in which a group of people form a set of relations in which the membership is not co-terminous with membership in one of the sets within a family institution. Where political institutions develop, therefore, a number of families must be resident within an area and in interaction through need for companionship, or protection, or cooperation in the practice of techniques of getting a living. Within such an aggregation of families, as we shall see in later chapters, other institutions may develop. At the moment, however, we shall only be concerned with political institutions.

Simple Political Institutions: The Rise of Mumis. In any group, whether it is a family or a group of families, leaders, as we have seen, develop as a result of disturbances or crises. In the family itself, the structure of the family institution provides the framework within which leaders operate. Here the sets of relations making up the family system are already operating, and the leader's place is determined within them. In a group of families, the leader builds up a set of relations in which the other members of the group terminate action to him; consequently the set is not co-terminous with any family set, and thus represents the beginnings of a new institution. Such a set we shall call for convenience the *Supervisory* set; it consists of the leader and his followers. When such a set arises, however, we are still dealing with what we may call an undifferentiated institution; it is not necessary to make any distinction between the political, economic, or religious institutions. No objective definition of such terms is possible except in terms of the coincidental development of other sets of relations, and these are dependent upon the type of crisis which occurs within the group.

Crises can be defined not only in terms of the intensity of the disturbances, measured in terms of the changes in the interaction rates of the individuals; they can also be classified on the basis of the relations in which they occur. In political institutions, the leader originates action to his followers in association with crises involving the external relations of the group, crises which bring about set events between members of the group and members of other groups. When two groups of howling monkeys meet in the forest, set events occur in which the members of one group alternately act as origin and termini, as each group alternately howls and shakes the branches, until one outacts the other. Among the Punans, when two groups come together, the approach of group to group involves set events, one

group halting, then advancing in unison with the other. Here too, leaders in these set events are differentiated; a man steps forward and originates to the members of the other group, and at other times his own group responds to his origins. A relationship of this sort, often spoken of by sociologists as the "we-group-you-group relationship," is, in fact, a set, the frequencies of which will depend upon the frequency with which the two groups come together. This set we shall call, for convenience, the *external relations* set.

Every institution has some kind of an external relations set. In the family, the father or grandfather or mother's brother, depending on the family type involved, acts as spokesman and leader when the members of his group are interacting with the members of another. In this case, however, the existing sets within the group are merely reinforced by the action of the leaders, and no new set, such as the supervisory set, is developed. The external relations set is therefore part of the family institution. If a separate institution develops in which the leader in the supervisory set is the leader in originating action to the members of another system, then we may properly speak of a political institution.

One point needs to be emphasized here, namely, that the membership in the system may include the members of a number of habitually interacting institutions who together are isolated from other systems. For this reason, a family or a factory, even though they possess an external relations set, would not be a political institution if the members were also members of other institutions. The total system includes all the institutions of an isolable group of individuals. This point will be discussed in more detail in Chapter 17.

Political institutions, therefore, develop as a result of the extension of the external relations set in which one person becomes a leader and directs the actions of his followers in originating to outside groups. To illustrate the way in which a system of political leadership operates we shall discuss in some detail a case which Dr. Douglas Oliver observed among the Siwai people of Bougainville.[1]

The Mumi (leader) of the village where Dr. Oliver worked was a man named Songi. His position, as well as that of the Mumis in other places, was maintained by frequent origins of action in set events. On some occasions he used to call together the whole man power of the village and set them working at some task. More often he used to call together a few at a time, or he would deputize some of the men to pass on instructions to the rest of

[1] Oliver, D. L., "Human Relations and Language in a Non-Melanisian Speaking Tribe of Bougainville, Solomon Islands," to be published shortly in *Peabody Museum Papers,* Cambridge, Mass.

his followers. In this set, Dr. Oliver isolates four classes of origins and termini.

In the early part of his paper, Dr. Oliver discusses the evidence which led him to the conclusion that a Mumi reached his position and maintained it through origins of action in set events. When he was originally endeavoring to find out what a Mumi was, he was given a number of criteria by the natives. These included the ownership of land, inheritance, possession of wealth, the ownership of club-houses or gongs, and the giving of feasts. By a careful survey of people who were generally agreed upon to be Mumis, he discovered that none of these criteria except the last had much significance. Many individuals who had much more land or wealth than Mumis were not considered Mumis, and it was explained that these people were stingy and never gave feasts. Moreover, some of the Mumis were almost poverty-stricken, at least from the point of view of their actual possessions. Oliver also found that the possession of gongs, or club-houses, was of little importance unless they had been built and paid for by the owner. Inheritance had little to do with the development of prestige. Only a man who gave many feasts and built club-houses, or provided gongs, and paid the people who worked for him, became a Mumi.

What this means is that property in any form which did not bring about set events had little effect on giving a man position. What was important was the continual giving of food, direction of workers, and general superintendence of activities of people of the village. The position in the set which resulted from these activities had to be continually reinforced by activities involving the whole village in its relation to other villages. The most effective of these was what Dr. Oliver calls "social-climbing feasts," by which the Mumi strengthened his position among his own followers and often forced rival Mumis to take an inferior position in his set.

A social-climbing feast was given by a Mumi and his followers for another Mumi to whom the first Mumi wished to become superior. For such an occasion elaborate preparations were made, accumulating vast stores of food and gifts to be presented to the guests. The guest Mumi had to balance the relationship at some future date by giving a return feast which would pay back this hospitality. If he was unable to make a return he was in disgrace and lost his ability to originate action outside his own village. Mumis who aspired to extend their set to include wider areas would carefully calculate how much food and gifts such and such a Mumi could lay his hands on, either through his own resources and those of his kindred, or from his followers and outsiders. He would then give a feast which would require the Mumi to pay back more than he could obtain from his available

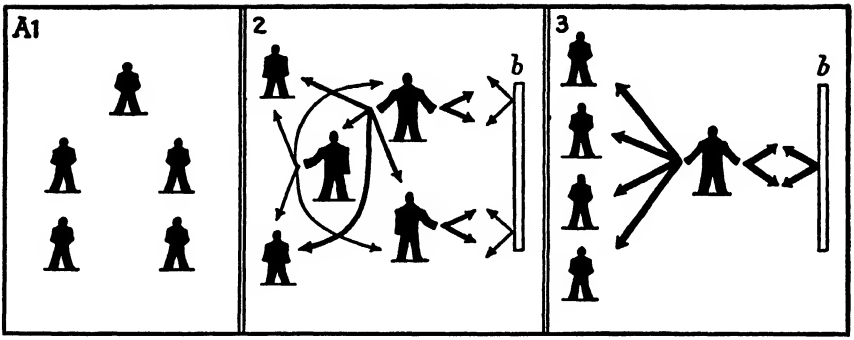


FIG. 7A. THE DEVELOPMENT OF POLITICAL LEADERSHIP: THE PUNANS

(1) A simple band of Punans, no Set Events. (2) Band b approaches from the right; b has no single leader. (3) Band b arrives; the two bands interact. A single leader becomes dominant and heads his set.

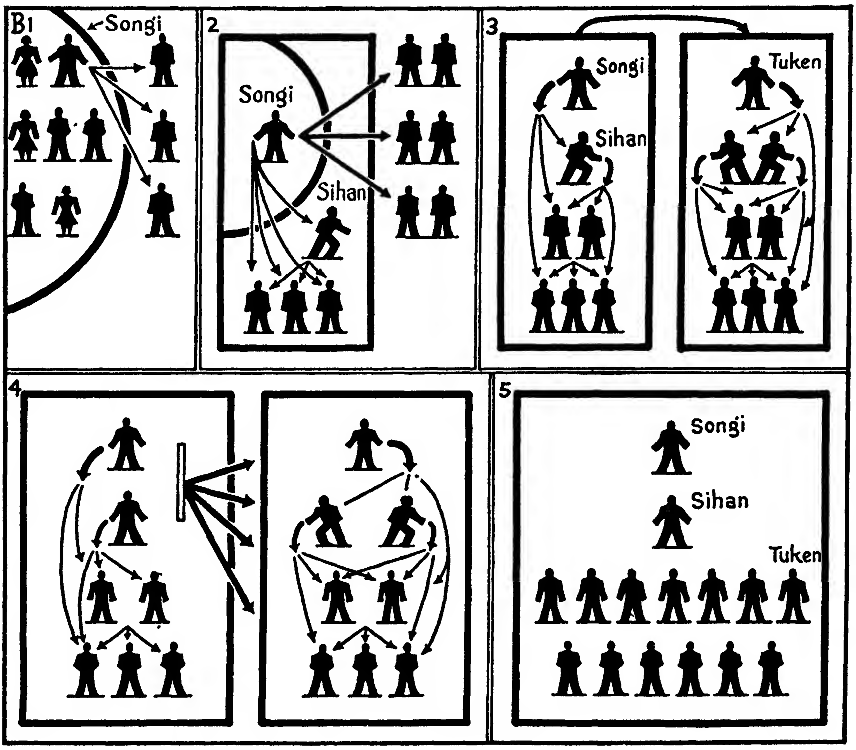


FIG. 7B. SONGI AND HIS SOCIAL-CLIMBING FEAST

(1) Songi and his family, plus a few retainers: his set. (2) Songi, with Sihan as lieutenant, builds up a simple political institution. (3) Songi's institution grows, and he invites Tuken to a feast. (4) Songi and Sihan originate to Tuken's group in sago preparation. (5) After the feast.

resources. By careful management of feast-giving, a Mumi could build up his set to take in more and more groups, until in time he might dominate a whole district.

Several incidents mentioned by Oliver show the mechanics of leadership. During the period of preparation for a great social-climbing feast, a short sequence of events occurred which show the requirements a Mumi must meet in order to maintain his set. The Mumi, Songi, had issued orders that all the men in the village were to go oppossum hunting. The night before they were to leave, a member of the class which only terminates, Class C, dreamed that bad luck would come if they went on the expedition. He told several villagers of his dream and warned them not to go. He was a dream prophet of some reputation. Songi soon heard about it when he arrived at the club-house, and said very angrily, "You are a crowd of women, all of you. Tsiha is a dream prophet, but who cares about his dreams? If I dream, that's different, that's something real." That night the expedition all set out as ordered, with Tsiha included.

In this case, Tsiha attempted to reverse the order of action in Songi's set. This would have resulted in breaking down Songi's position as a member of Class A, that is, the class of those who only originate, for if the situation had continued Tsiha would have originated to Songi and his followers. By quickly originating action, Songi restored the equilibrium of the set and forced Tsiha and the others to respond to his origin.

Similar situations occur in every institution, and if the authority of an individual in Class A of a set is to be maintained, he must originate and restore the equilibrium. That is what is meant by maintaining discipline in an organization, no matter whether it consists of the authority of a father over his children, of a foreman over his workers, or of any other leader over his followers. In military organizations or on factory shifts, rapidity in restoring the equilibrium is essential, because once the followers fail to respond to a leader's origins in several events, it requires drastic methods to restore his authority.

The process of expanding a set is well illustrated in the description of Songi's incorporation of another village into his system. In this case, in carrying out the preparations for the big social-climbing feast, Songi decided that he needed more help than he had available. He asked Tuken, head man of Rennu village, to assist him. Songi and Tuken had for some time been interacting, and used to assist each other by exchanging pigs or money. When the Rennu villagers came over to help prepare food for the feast, they were supervised by Sihan, who was in charge of the cooking and was immediately under Songi in authority. Sihan originated action to mem-

bers of both villages, including Tuken, and directed the process of preparing sago palm. Now Sihan was not the only one to originate to the Rennu villagers, for Songi soon began to do so too. For a while Tuken occupied Class B in Songi's set, as Songi transmitted directions through him to the Rennu people. Gradually, however, Songi became less and less dependent upon Tuken for this service and began to originate more and more to them directly. Finally, after the feast was over, this situation continued until the point was reached at which the Rennu villagers gave up their own clubhouses and came over to use Songi's. In this case, two systems of relations were merged because the Mumi of one system began to originate directly to the other Mumi's followers.

What actually happened was this. Tuken, the Rennu Mumi, did not try to maintain his origins at their accustomed rate during the feast preparations, since he found Songi and Sihan already directing. Because of the increase in total interaction which took place at this time, he felt no disturbance in his own rate as he was receiving the customary amount, and his increased interaction in pair events during the feast activities compensated for the decrease in set events. Thus Tuken did not know what was actually taking place; in the meantime the frequency of events which had made Songi the leader had become established, and this new interaction rate persisted after the feast had ended. Tuken had failed to reinforce his leadership and so he lost it.

The maintenance of leadership in a political system such as this requires the continuous efforts of individuals who have a high origin rate and, in particular, a high origin rate in set events. The process of developing control is an unsteady one in which the individual must constantly be ready to originate in set events and must not terminate to competing Mumis. In most political systems there is, therefore, continual competition as rivals fight for the control of a group.

Tangent Institutions. Where more than one institution is found in a group, or where a single institution is divided into strongly developed subsystems, it is very common to find that individuals belong to more than one institution. In this case, we speak of the institutions being tangent to one another through the individual who interacts in both. If other members of the two institutions who interact with this particular person begin to interact with one another, we call the relation in question a *tangent relation*. Thus when the mother of a boy goes to see the boy's teacher and discuss with her the reasons for a bad report card, the two are interacting in a tangent relation, and the two institutions—the family and the school—are

tangent to one another through the boy, who is a son in one and a pupil in the other.

In the following chapters, we shall occasionally mention tangent institutions and tangent relations, and the reader must remember that the institutions are related through an individual who is common to both. In Chapters 17 and 18 we shall discuss tangency in detail, because as we shall then see, it is of fundamental importance in the development of equilibrium in societies. In the present chapter, however, we intend to deal with it only as a means of relating sub-systems in the political system to other institutions, because the supervisory set in the political institution as well as the external relations set includes all the members of the group. Strictly speaking, therefore, the political system includes all other institutions, but as we shall see, nevertheless, unless sets of relations are developed which relate sub-systems within the political institution, the relations of members have to be conducted through points of tangency within the total institution. Thus the relationship between Songi and the members of Tuken's village passed through a period of tangency before they started to terminate as members of his system. This only resulted, however, when Tuken inadvertently occupied a place in Songi's set in the preliminary preparations for the great social-climbing feast. Once Tuken terminated with others of Songi's followers, the tangency was established.

The case of Songi illustrates the essential elements of a political leader: he is the focal point of a complex equilibrium in the supervisory and external relations sets. These sets are mutually dependent: an increase in one causes an increase in the other. As every leader knows, one of the best ways of maintaining leadership in the supervisory set is to promote a conflict with another group which thereby increases the origins in the external relations set; this was the purpose of the social-climbing feast. Not only did it serve as a means of increasing the membership in the terminating class of the supervisory set when a rival Mumi was conquered, it also increased the interaction within the supervisory set through the countless events connected with the preparations for the feast.

As was noted in our description of one of these occasions, much of the activity is centered around the techniques of preparing food, obtaining wealth through loans, and so forth. The activity in the set, therefore, consists not only of set events making up the supervisory set by which Songi controls or delegates control of the activities of his followers. It also consists of pair events in which gifts, loans and material are brought to Songi and other events in which he distributes them to his followers or to rival Mumis from time to time.

When crises arise with greater frequency, the leader is unable to devote all his time to procuring his food and clothing; he must spend much of his time supervising other people's activities, discussing problems of external relations with leaders from other groups, and in general maintaining the system in a state of equilibrium. He, therefore, needs support from the termini in his system if he is to devote all of his time to political leadership. In the simpler societies this support comes from gifts which his constituents give him, and in more complex groups this system of gift-making develops into more elaborate systems of taxation, in which the amount of goods, money, etc., which each person gives is regulated in advance and is compulsory. The gifts do not always, however, consist of goods; they may take the form of services. Thus in Negro Africa, it is a common practice for each of the different families or villages in a native kingdom to give the king a wife. With this polygynous household he can produce not only a large family linked to all parts of his kingdom by kinship, which strengthens the set with tangent relations, but he can also obtain an abundance of foodstuffs, since it is the women who produce most of the food in that region. Again, each of the men in his kingdom may be obliged to spend a certain number of days working on the king's fields, as is the case among the Azande. This practice is extremely common, having been employed by the Incas in Peru, the Natchez in Mississippi, and the feudal lords all over Europe. Even today in rural New Hampshire, it is possible to work off your town taxes by doing a number of days' work on the roads, and many farmers do this.

The support of government officials is not, as we have seen, the only reason why a leader is given gifts, or why the government collects money. Goods are also needed for the maintenance of leadership. In the simpler societies, where there are but two classes in the set, the leader and the led, this can be easily illustrated. The followers give the leader gifts in pair events, and he distributes them back to the people in set events. In Chapter 11 we gave the procedure of the Bushman chief in distributing meat as an example of sharing. It is also an example of the habitual interaction of a leader in acting as a clearing house for food and other goods on the simplest level of social complexity. The chief receives the game in pair events, cuts the meat and divides it into separate portions, and hands it out to the other members of the band in a set event.

In Homeric Greece, the king is portrayed as a man who governs the inhabitants of a small area, consisting of a few villages and their fields and woodlands, from his palace. People bring him gifts of grain, cattle, oil, and other commodities, so that he accumulates a relatively large reserve in the palace storerooms. At regular periods he entertains the nobles of his king-

dom, who serve as Class B in the hierarchy, with sumptuous feasts, and he keeps open table every night in his hall to serve anyone, constituent or stranger alike, who may care to come.

This same practice is preserved in the mountains of Northern Albania, where local bairaktars, or chiefs, keep open table for anyone who wishes to eat and to talk with the leader, his family, and his retainers. Songi, in Bougainville, attained his power as a Mumi simply because he had that ability of leadership which made it possible for him to collect food from others singly and give it out again in set events.

Among the Bemba of Northern Rhodesia, the system was somewhat more elaborate than in the examples just cited; the common people did their share of agricultural work on the lands of the king as well as on those of the local chiefs, and at the same time paid a regular system of tithes on their own produce. At the king's court, the tribal councilors are fed by the king's wives, and all of the volunteer laborers are also fed for at least one day of their service on the royal estate. Here the king's wives are organized into quite an elaborate hierarchy which has charge of preparing the food and brewing the beer used in these activities.

This role of the leader, or of the government, in acting as a clearing house for materials is a basic factor in the maintenance of equilibrium in any political institution, and hence it is found in some form or other in every political system. In American city government, we have long become familiar with the local "boss," the politician who keeps himself in office through the maintenance of a well-organized political machine, that is, a group of followers who will at all times do his bidding. Political bosses are particularly successful in developing control over a political institution in areas in which large groups of people are continually disturbed in their equilibrium through poverty or inability to modify the origin rates of governmental officials to themselves.

The poor wards of every city develop just such bosses, who organize their followers into a voting unit by giving them jobs, getting them out of trouble with the police, "fixing" the courts, and in general by stabilizing their equilibria. At the same time they control the actions of their followers in set events at political meetings and elsewhere through the properties of their interaction rate and the discipline of a "strong arm" squad. The source of the funds they distribute to maintain their following may consist of business institutions seeking adjustments in the effect of governmental action upon them, or it may come from sale of government jobs or contracts to those who will pay the boss a satisfactory percentage for the privilege.

Fundamentally, however, the causes of "bossism" are not the natural depravities of politicians; rather they result from the inefficient and inequitable operation of the governmental institution itself. The boss, as Lincoln Steffens showed, acts as a cushioning force.[2] He is able to maintain or restore the equilibrium of individuals and groups. Bossism can only be eliminated when conditions producing it are eliminated. The elimination of such political leaders through prosecution merely means that new leaders will rise under the same system and fill the same places.

Among the Omaha, with whose general activities we are already familiar, the political institution was more complicated. A man who wished to become a chief had, of course, to make extensive gifts to those who already held this rank in the political hierarchy. Now there were two classes of chiefs among the Omaha; the Nikagahi Shabe, or Seven Peace Chiefs, and the Nikagahe Xude, who were unlimited in number. The Nikagahe Xude were men who had won a certain rank of war honors which entitled them to wear the emblem of the crow as their insignia. From their number the Seven Peace Chiefs chose the hereditary leader of the buffalo hunt, and also the "soldiers" who acted as police. It was also from the ranks of the Nikagahe Xude that the Seven Peace Chiefs themselves were selected.

The gifts which candidates for these offices had to give were regulated in type and value. Each candidate had to make a certain number of them to the Seven Peace Chiefs before they let him into the Xude order. To rise further to the rank of the Seven Peace Chiefs themselves, candidates from among the Xude had to give them more gifts of much greater value, and the Seven Peace Chiefs kept the number and value secret.

This system did not permit any person to rise who could only accumulate property, since a man had to have obtained war honors through bravery before he could be a candidate for the Xude; and before he could become a member of the Seven Peace Chiefs, he had, of course, to be approved by those already in office. In case an undesirable person began to make gifts, the Chiefs had the right to refuse them.

Despite the constant flow of goods in their direction, the Seven Peace Chiefs did not grow rich. They were supposed in return to entertain visitors and give presents to bereaved people, with the result that they handed out as much or nearly as much as came in. Furthermore, they did not necessarily have to have much wealth to begin with; a likely candidate would be able to collect goods from his relatives with which to make up his presents, and whether they supported him or some other kinsman would depend on his personality, and that of his possible rival. Hence in the long run among

[2] Steffens, Lincoln, *Autobiography of Lincoln Steffens,* New York, 1931.

the Omaha, as among every people anywhere, a rise to leadership depends on the high frequency of the individual's interaction rate, his ability to originate at a high frequency in set events, and to respond in pair events. It would be possible to give numerous examples of the way in which individuals rise in other societies, as in the Potlatch on the Northwest Coast,[3] and the Sukwe society of the Banks Islands,[4] as well as in our own, but space does not permit.

II. WARFARE

Conflict—The Background of War. In the relations of one group to another, a situation frequently arises in which one or more individuals in Group A originate action to members of Group B, and the latter originate in turn. These origins of action do not come regularly or with an expected periodicity. Each person interrupts and tries to shout the other down, and this lack of rhythm activates the sympathetic nervous system and causes the origin rates of both individuals or parties to rise. When the frequencies of these two sequences of origins are thus accelerated, the equilibrium of both groups is correspondingly disturbed, and the individuals in question try to compensate for this upset by increasing their origins and maintaining the earlier ratio of origins to responses. Such a situation, described here solely in terms of interaction, is called a "conflict." The reader may insert any example he likes, from the beginning of a fight between two neighborhood gangs of boys to the events in Europe which led up to England's declaration of war on Germany in September 1939.

During the course of a conflict, the origin rate of both sides is increased until one side reaches its maximum, at which point the other side achieves and maintains a higher rate of origins than the other. Once this occurs, the losing side, that is, the individuals who are terminating more frequently than their rivals, must either accustom themselves to the situation or else restore their equilibrium by withdrawing from all interaction. In plain language, they must either give in or run away.

We have already seen examples of conflicts among howler monkeys, shipwrecked sailors, and would-be Mumis. None of these were lethal; they consisted entirely of jockeying for position, either within or between groups of individuals. There comes a time, however, in any conflict, if it proceeds far enough, when the origin rates rise to such a pitch and the emotions of the contestants become so aroused that such activities as gift-making and

[3] Boas, F., *The Social Organization and the Secret Societies of the Kwakiutl Indians,* report of the U. S. National Museum, 1895.

[4] Codrington, R. H., *The Melanesians,* Oxford, 1891.

conversation do not suffice, and the parties resort to physical force to compel response. This is the point at which a conflict becomes a war.

In even the simplest kind of war, such as a Riffian or Kentucky Mountain feud, origin of action must be balanced by origin of action, and crisis by crisis. If we kill one of your group, you will not rest until you have killed one of ours, and only in one of the brief periods when the score is for the moment balanced can our two groups make peace. This is well illustrated among the Ifugao of the Philippines; two groups may negotiate through an intermediary for an exchange of gifts and thus bring a feud to an end. If they continue to exchange gifts at regular intervals, it will help to build up a constant rate of interaction and establish an equilibrium between the two villages, making the outbreak of a second feud more difficult.

Conflict situations arise most readily in cases where no stable relations exist between members of two groups. If an Ona, walking along the upper flank of his band hunting territory, on the outlook for guanaco, sees a member of another band approaching him, he will generally crouch into ambush position and shoot the stranger, who can be there only to poach or to steal a woman. If two parties of natives meet in the bush in New Guinea, the chances are that they will likewise fight each other, unless they are members of neighboring villages which have established friendly relations.

In most primitive societies, a stranger is immediately considered an enemy, whether he arrives alone or as a member of a visiting group. His presence is a disturbing influence, and the easiest way for the people whose privacy he has invaded to restore equilibrium is to drive him off or kill him. Whether or not he can escape these alternatives and join the group depends on his ability to establish relations with them through tangent institutions. He may, as in Australia, find some common kinsman and thus be fitted into the kinship system of habitual behavior. He may have something to trade which they want, and of which, if they kill him, they will have no chance to get more. He may be a co-religionary, as in Morocco at the time of the Riffian War, when the Spanish deserters would be spared if they approached their captors shouting, "There is no god but Allah, and Mohammed is the messenger of Allah!" He may belong to the same secret society, as in Liberia.

Warfare, therefore, is the result of the failure to establish such relations. All wars, however, are not the result of a single situation in which two groups come into conflict. In some societies, warfare is a normal condition, and is necessary to maintain the equilibrium of the groups involved in it. Many American Indian tribes went on the warpath every year at a given

season, usually the late summer or early fall. This was particularly the case among the tribes of the Southeast, the Iroquois, and the Plains tribes. This was a season in which there was little else to do; what agricultural work the men were concerned with was finished and the game was not yet prime for the annual hunt. The annual war expedition served as a means of keeping the population down, of establishing a political hierarchy in terms of the military set, of building up an age-grading system through initiating boys by taking them on their first war party, and of establishing rank through performance of designated exploits, such as touching an enemy with the hand, taking a certain number of scalps, etc. Warfare, in fact, provided the basic framework for their entire organization, permitted the orderly exploitation of their environment in terms of their technology, and gave them an outlet for their necessary interaction. In these several ways it served to maintain equilibrium among these peoples. This aspect of warfare will be discussed further in Chapter 26.

Leadership in Warfare. In the simplest societies, when conflicts between groups of people occur, the men who lead their groups into skirmishes, ambushes, or battles are usually the same men who make decisions in peacetime. However, it often happens that a man capable of leadership in ordinary affairs is not physically strong enough to lead his people in war, particularly if he is too old for fighting. In such a case, the usual procedure is for the chief, or the people, to select another man to serve as leader in time of war, and ordinarily such a leader relinquishes his position in Class A in the supervisory set as soon as the war expedition is over. This comes about in the same way that the Seven Peace Chiefs among the Omaha select a leader to take charge of the buffalo hunt.

Among the Ruwalla Bedouin, if the sheikh of a tribe is unable to lead his people in battle, he selects, with popular approval, a sheikh esh-shedad, or war-sheikh, in his place. This war-sheikh is supposed to retire in peacetime, but often fails to do so as the set of relations which he has established in battle, where the interaction is high, may supplant those between the civil sheikh and the same group of termini, especially if the war is long and the events frequent. For this reason few sheikhs consent to the appointment of a war-sheikh any sooner than they have to, and few of them long survive this appointment, since the events of war are nearly as frequent as those of peace among this people, and this tribe, which consists of a single expanded family with its dependents organized in closely knit tangent sub-systems, is too simply organized to permit the co-existence of leaders in separate institutions. Among more complexly organized peoples, as among the Aztecs, where warfare was as important as peacetime activities, the head of the war

institution was a separate official almost as important as the head of the state; the so-called "Snake Woman" of the Aztecs was second in rank only to Montezuma.

A war chief in any society is not necessarily the bravest man in the army. It is more important that he be a good organizer. According to Musil,[5] the Ruwalla recognize three kinds of men, all of whom make good fighters, as follows:

1. *Sahib el marjala:* such a man is brave, has a broad outlook, thinks of the future, and never acts hastily. This kind of man makes a good chief.

2. *Sahib el farsa:* a brave, dashing, reckless fighter, but of no use as a leader.

3. *Sahib el mrawwa:* this is the best kind of all, found only among the most popular of chiefs; in addition to the qualities of 1, he will give up his rights to a smaller man without insisting on them—he knows humility.

A war leader, therefore, must have the qualities of leadership which are needed in any institution. Men of the *sahib el farsa* type are found in many armies; among the Plains Indians there were whole companies of eccentric fighters called "Crazy Dogs," who would perform all kinds of feats of reckless bravery; among the Vikings likewise there were men called "Berserks" who wore wolf skins, howled like wolves, and bit the rims of their shields. The berserks were said to have rushed into battle individually, hacking at everyone in their way, and never turning back. In the American Air Force during the First World War, there were a number of "haywire" pilots who were noted for their bravery in dog fights, and who used to frighten people by flying under bridges or under the struts of the Eiffel Tower. The Crazy Dog, the berserk, and the haywire ace were men of exceptional bravery who did not possess the power of leadership, or for some reason could not attain it; their actions can be explained as an outlet for their high origin rates; since they could not obtain leadership in set events, they compensated by becoming very tough and eccentric. In the case of the berserks, many were apparently younger sons who had no inheritance and went about the countryside challenging property owners to "holmgangs" (which were single combats, see pp. 632-635) in order to relieve them of their wives and estates. In other cases they joined the retinues of princes as a special branch of the service and were rewarded in the measure of services rendered.

The Organization of Armies. The simplest war parties of which we know are those in which the members of a family or of a band get together under the leadership of a single person and raid some other band or family.

[5] Musil, A., "Manners and Customs of the Ruwalla Bedawin," American Geographical Society, Oriental Explorations and Studies, No. 6, New York, 1928, p. 471.

In such a case the system consists of a single set with one individual originating to all of the others. However, the frequency of his origin rate may not be high; the individual warriors may go off by themselves to carry on single combats with special enemies, or they may leave to go home before the fight is over.

In more complex societies, where conflict between groups is more frequent and extensive, we see the emergence of more highly organized and more carefully trained war parties, consisting of a leader, several lieutenants, the main body of warriors themselves, and quite often a group of camp followers who assist in the activities of the expedition up to the moment of the actual combat. The best-known war parties are those of the American Indian, in particular those of the Great Plains and of the eastern United States. Among most of these peoples, where the pursuit of war honors and booty was of such importance, the leader of a war party ordinarily selected his followers before each expedition, and the organization which resulted was a simple supervisory set with three classes.

In most of the North American tribes a system of war honors had been well worked out. The different activities in war were graded and each grade entitled the warrior to certain privileges in the political hierarchy. Among the Omaha, the highest honor was to strike an armed enemy with a hand or bow, and other honors were graded in order of difficulty. Only men who had obtained honors in the higher grades were entitled to wear the "Crow," a ceremonial garment symbolizing warlike activities, and only wearers of the Crow were eligible to be soldiers on the annual buffalo hunt. Among the Omaha, too, departure on aggressive war parties was strictly controlled, and each war leader had to obtain permission from an official known as the "Keeper of the Sacred Pack of War." The leader and his followers met with the Keeper four times, partaking each time of a simple meal. After the fourth time, the Keeper of the Sacred Pack explained to the leader how he must perform his duties, and how to organize and conduct the party when scouting, and attacking the enemy. Just before they were ready to start, the men of the war party, led by their leader, went through the war dance. After this they departed in secret and met at an appointed place. This was to prevent any others from joining the party. These activities, some of which will be discussed later as they are symbolic in nature, built up of a set of relations between the Keeper, the leader, and the members of the war party. The four meals and the war dance instituted a system which through repetition developed into a set. Once this had been accomplished, the secret departure naturally followed as a mechanism to prevent other individuals from becoming part of the system.

In more complex societies, where the population of the group is larger and the number and variety of institutions greater, true armies develop. Except for the Inca Empire, no group of American Indians arrived at the point of instituting a professional army with full-time soldiers. Such armies, indeed, have been found elsewhere only in Europe and Asia, and among the more complex African kingdoms, such as Dahomey.

Elaborate armies, such as those of the United States and of modern European nations, constitute the most highly organized institutional systems known. These systems are characterized by an extremely high frequency of the supervisory set. Almost every event extends from the commander-in-chief, as origin of action, to the common soldiers, through the dozen or so intermediary classes of officers. Here discipline is at its highest; that is, the frequency of set events occurring from each class of originators to the next class of terminators is high and regular and responses must be immediate.

In other institutions, the class of terminators must be able to originate to the members of Class A of the supervisory set, at least in pair events, if equilibrium is to be maintained. In the army, however, this is not necessary or even advisable, since the external relations set is also extremely high and the soldiers need all of their energy to originate in combat to the enemy. That is why they are also kept away from their wives and families and completely provided for in the matters of food, clothing and shelter. That is why they cannot even talk to each other while in rank formation, but must wait until the command "at rest" is given. It is also the reason why they must not interact in other institutions while the military institution is in operation.

Another reason why the supervisory set is so strong and why the termini cannot talk back, is that obedience is necessary in maneuvers. Large groups of men have to be moved about over what is often very rough terrain, and during this process the relations between the classes in the hierarchy have to be maintained, so that all will be ready to respond to orders. The greatest care is taken to make sure that all commands (set events) are executed with speed and in the proper order. Owing to the necessity of making rapid changes in the position of the troops on the battlefield, set events within the administrative hierarchy take place at a high frequency, and any origins of action which run against the direction of the sets are severely punished.

A military system has to have an extremely stable equilibrium, since otherwise the decimation which takes place in battle would cause serious disturbances in the relations of the soldiers, and once the system loses its ability to cohere in the habitual patterns to which it has been conditioned, it might disintegrate completely before a better-organized foe.

As a result of this, an army is made up of individuals who are almost completely conditioned to their position in sets, and hence it is the most conservative of all types of organization. Such an organization, by its emphasis on set events and on routine interaction between members of pairs, is liable to lose its capacity to adjust to changing circumstances, and it is often difficult to introduce new weapons and new routines of interaction. The principal problem of military genius is how to secure an equilibrium in an organization stable enough to maintain it against serious shocks and yet at the same time to keep the system flexible enough so that the soldiers can adjust to changes which arise in the course of the battle. Every American has heard of the British Redcoats marching in close formation along the highways during the Revolution while Minute Men sniped at them from behind stone walls and elm trees. That, and the failure of the French army to change its tactics in 1939 and 1940 to meet the new German mechanized warfare, are classic examples of a fatal military conservatism.

With the exception of modern industrial institutions, the army is the outstanding example of an extended supervisory set. In the American army, for example, the sequence of origins goes from commander-in-chief to major general to brigadier general to colonel to lieutenant colonel to major to captain to first lieutenant to second lieutenant to master sergeant to sergeant to corporal to private, making thirteen classes, or eleven divisions of Class B. In some instances even more classes are interposed in this set.

In modern armies such as our own, two other sets are also represented, the *Staff-line* and the *Processing*. The staff-line set is that in which interaction takes place between such parallel departments as the quartermaster general's, the paymaster general's, the medical service, the intelligence service, the chaplain service, and the line organization itself. This set is not as extensive as in most of the equally complex economic or religious institutions, however, because of the extremely high frequency of the supervisory set caused by the necessity for discipline. Within each of these departments, the presence of the supervisory set is evidenced by the fact that men who are actually physicians, clerks, and priests must all have their military rankings.

The processing set, on the other hand, is that in which separate kinds of specialists in divisions and subdivisions of the technique of fighting interact with each other in terms of their special techniques, just as the specialists in an automobile factory work with each other. The specialists include snipers, scouts, skirmishers, etc., in simple armies. In the armed forces of the United States they include the two primary services of the army and navy,

and within these such branches as the infantry, cavalry, artillery, air corps, etc. Within a single ship of the navy they will include navigators, engineers, gunners, torpedomen, etc., with each group interacting with each of the others in terms of its special technique under the direction of the supervisory set, which, except in moments of actual battle when the external relations set is in action, acts always at the highest frequency of all.

Warfare and Technology. The student should not be surprised at this point to learn that warfare has a close relation to technology, and that the complexity of an army or navy is a function of the complexity of the techniques available to the people who comprise the political institution. When two bands of Australians fight, there is no differentiation of forces. All of the men hurl spears at the members of the opposite force, and occasionally throw clubs and boomerangs. If they close in in hand-to-hand combat, they may fight with thrusting spears or clubs. This same principle applies to most primitive armies, where the soldiers are not as a rule specialists. The American Indians fought almost exclusively with the bow and arrow and the club, the Melanesians with the same weapons; neither was divided into separate services. In the Roman army we find infantry, cavalry, and artillery, the latter utilizing the advanced war engines, such as the ballista, onager, and the like, which were the product of Alexandrian science. Our own army has a much more complex organization now than it had in the days of the Civil War, when there were no such things as tanks, airplanes, and antiaircraft guns.

These technical devices have not only increased the interaction in the staff-line and processing sets, but also in the supervisory, since the number of soldiers in an army has greatly increased with the general technological advance of nations. The greater the number of soldiers, the more complex the organization that is needed to regulate it.

III. INTERNAL ORGANIZATION: THE STATE

Introduction. In all complex societies a distinction is made by the people themselves between the civil and military hierarchies. This distinction reflects a difference in the relative frequency of events in the various sets which make up a political institution, and in the persons who terminate in the two hierarchies, as well as in the personnel. In a military organization both the supervisory and external relations sets operate at a high frequency, to the exclusion of most other relations. The operation of the external relations set, however, does not go on constantly as does that of the supervisory set, but only in time of war. In a civil organization the external relations set involves more groups but operates at a much lower frequency, and the super-

visory set varies in its rate of activity and includes all the members of the group. Other sets, such as the staff-line-and processing, may rise in frequency, and civilians will interact in other institutions much more than members of the military hierarchy are permitted to do.

In simpler societies, as we have seen, this distinction is less marked. Among such peoples as the Iroquois, the Omaha, and the Arabs, the military system only operates in time of war, and the members interact as civilians in the meanwhile. The man or men who lead the war parties are usually the same as the civil leaders. In our own government we have the National Guard and Naval Reserve organizations, the members of which interact in the military sub-system with a low frequency but emerge from civilian life in times when relations between our own state and others reach a certain level of activity. There is, however, a regular army and a navy ready for action even when no conflict exists, owing to the time necessary to train men and assemble equipment. Among the Iroquois, Omaha, and Arabs, the training is simpler and the equipment easier to get together; hence there is no need of a standing army between conflicts.

Spatial Position and Political Systems. The simplest type of political institution is a band of men and their immediate families who have come together under a single, personal leader. A good example of this is found among the Tehuelche of Patagonia, a food-gathering people who hunt on horseback. They are able to form such gangs, of as many as one hundred and twenty-five persons, covering a territory with a radius of fifty miles or more, because of their superior transportation. By the same means, however, they are also able to raid each other's camps for horses and for the use of hunting territories, and these activities result in consolidation under a single leader.

This simple situation of a band under a single leader was much the same as that of Songi in Bougainville and his followers, and as far as we can make out, many famous political leaders in the past have begun with no more complex an organization than that. The army of William the Conqueror and the Greek expedition that attacked Troy were organizations of different-sized groups of followers under the personal domination of single men.

Every group of people who constitute a political institution, even if it be as simple as those just cited, has some spatial identification, some association with a particular part of the landscape. Hence there is a geographical factor involved in the building up of the state. Among the Australians, the horde, which is a paternal, age-graded clan, has a special hunting territory

with which it identifies itself, and which it considers its own country. In the central valleys of California, each village of acorn-gatherers identified itself with the small territory in which it was situated and from which it derived its food, and even among such widely scattered boreal forest people as the Naskapi, the band and the hunting territory were coterminous. Whatever the technology of a people, it has some association with the land upon which it lives and from which it derives its sustenance. Every political institution, as well as every band and family, in cases where separate political institutions do not occur, has its country, just as the Americans, the French, and the Germans have their countries.

This fact of spatial position is at the root of the development of complexity in political institutions above the level just cited. Once a set of relations is built up within a group of people so that leaders, subordinate leaders (members of Class B) and followers are differentiated, the basis has been laid for a further specialization of the political organization. In its simplest form, this specialization consists merely of the development of local subsystems within the main system, and these are usually based on spatial position. A man who is the leader of a small group of people living in one area may rise to become the leader of a number of such groups, and he may do this by retaining and appointing a subordinate to act as local leader in each of the groups under his authority. This kind of specialization, consisting of the coordination of a number of local groups, is the most widespread type of political organization above the level of a single band and its leader.

In many societies one also finds a camp, a village, or a town divided into areas. Sometimes there will be two parts, as in the camp circles among the Plains Indians, where the division of the tribe into two moieties was spatially represented, with members of each moiety living in its own half of the circle, and members of each clan in its own particular section of its moiety area. A number of peoples divide their town or villages into wards. This is the case among the Berbers of Siwa Oasis, the Algerian Kabyles, the town-dwelling Arabs in both Asia and North Africa, the Ifugao, and ourselves. Although in our cities the wards merge into one another imperceptibly, in these other cases it is usually customary to separate the wards with walls and to lock the gates between them at night. Within each ward, in either case, there is usually a ward council and ward leaders, who send representatives to the town or city council.

The Inca Empire. The grouping of individuals into political sub-systems based on geographical areas becomes increasingly systematic in large states and empires. One of the most elaborate systems of this kind, which we shall

use here as an example of how such an institution works, was the empire which the Incas in Peru developed.[6]

The administrative hierarchy consisted of nine ranks of officials beginning with the Inca. The empire was divided into four quarters, and each of these had a ruler who was directly responsible to the Inca. In each quarter were officials who ruled an area containing 40,000 households, and under them were officials who ruled 10,000, 1000, 500, 100, 50, and 10. Each rank of official was appointed by those immediately above him in the scale.

Similar geographical divisions, although not based upon such precise statistical categories, are to be found in every country. Our own system, with town, cities, counties, states, and the federal union, is one example of this. In some states we have further developments of areal groupings such as sanitation districts, school districts, etc. In all complex states, hierarchies are developed which coordinate such geographical divisions under a single leader.

Among the Inca, the hierarchy was based upon the number of households, and the area itself was not the primary division. The West African kingdoms such as Benin, Dahomey, and that of the Hausa states were divided into provinces which were ordinarily based upon old tribal divisions. In these cases only the top of each local hierarchy was usually appointed by the ruler, and the lesser chiefs were those who inherited their position or were chosen by village councils. Only among the Incas, as we have seen above, were individuals selected for administrative positions by means of a completely uniform system. Once an administrative hierarchy like that of the Incas, which includes a large number of areas, is developed, the maintenance of the system requires the elaboration of departments to help interrelate the officials in the different areas and control the more important tangent institutions in the country.

States conquered by the Incas were incorporated into their organization, and the former rulers were very often given positions equivalent to their old ones. In order to supervise the various divisions of the Empire, there were a number of officials, usually of the blood imperial, who periodically inspected the various administrative divisions. They reported directly to the Inca, and thus helped to maintain the organization of the system. The heads of ten families and fifty families supervised the labor of the heads of households, seeing that they had a sufficient amount of food, clothing, seeds, and tools, all of which came from the state. They maintained discipline, reporting graver infractions to their superiors, and they kept a record of the vital

[6] Means, P. A., *Ancient Civilizations of the Andes*, New York, 1931; *The Fall of the Inca Empire*, New York, 1932.

statistics in their groups which they gave to the higher officials every month.

Every family was obliged to sow crops for the Inca and for the State Church, to reap them, and to carry the harvest to the storehouses. Every farmer in the Empire had to serve for a brief period each year in this way. Labor in the mines and elsewhere was contributed in the same fashion. At regular intervals, tax collectors and accountants calculated the amount of labor which the people had performed, and the time which they had spent at crafts and at other tasks in which they had been employed. This time was deducted from the tribute each individual family had to pay.

Associated with the system of production was a system of markets which was a part of the administrative hierarchy. Beside this the Incas had a highly developed system of post roads and official inns, and a highly organized army. One further development which had been worked out in their administrative procedure was the system of moving Indians from one province or administrative district to another in order to reduce over-population, develop efficiency in agricultural production, and open up new territories. This also enabled the administration to break up dissident groups by mixing their populations.

These procedures were also quite widespread in the Near Eastern kingdoms of antiquity as well as among the Medes and Persians, in the Roman Empire, and in modern Germany, but nowhere else were they so efficiently utilized as among the Incas. The men were able to use them because their system of records, involving highly developed statistical procedures, enabled them to keep a constant check on the production in any administrative district, however large or small. If one group grew too large, or if its members were unable to raise a sufficient amount of produce, the government could adjust the size of the population to fit the needs of the area.

We have no other example in history where the activities of so large a population, including, by the most conservative estimates, at least 16,000,000 people, were so minutely regulated. As Means point out, the Incas were able to do it because their techniques of getting a living and producing a surplus were so limited that no new procedure could upset the system, and also because their knowledge of statistical procedures, which made a high degree of control possible, was limited to the upper classes, who alone were allowed to attend the Royal College.

The Inca Empire, therefore, developed an administrative system which was not very different from that of any expanding military power, except for the use of one important technique. This was the invention of the decimal place system and its thorough-going utilization in administrative work. So accurate were their records that the ruler of a province could be

aware that a pair of sandals was missing. By the use of the Quipus (the knotted strings which they used for calculation) the interactions in the administrative hierarchy took place with a regularity only possible with such an intensive use of a numerical place system. But the opportunity to develop such a stable system of equilibrium was also furthered by the isolation of the Inca Empire from any neighbor whose attacks could seriously disturb it. Nevertheless, the development of the complex organization itself was the result of a high frequency of origins of action in the external relations set. It was probably the process of conquest which brought about the internal elaboration of the system.

Departmentalization: The Rise of Bureaucracy. Although the Inca Empire was a highly elaborate system of administering a large area, it was not really very complicated, since there were few departments and few subsidiary or tangent institutions. Truly complicated systems, in which individuals interact at a high rate of frequency in the staff-line and processing sets as well as in the supervisory set, arise only in societies which are themselves complex—that is, which employ complex techniques and in which a large number of different institutions have arisen. Such is the case with European governments of the present day and with our own federal and state governments.

Within the Commonwealth of Massachusetts, for example, the processes of division and isolation resulting from these forces have been so great that between many of the departments into which the state government is divided no habitual relations have been developed, and they represent, in effect, groups of tangent systems all forming part of a larger system. In such a commonwealth as that of Massachusetts, the major divisions of the administrative system are numerous. Directly under the governor there are fourteen commissioners who supervise the Departments of Taxations and Corporations, Public Health, Banking, Mental Health, Education, Public Welfare, Public Works, Civil Service, Correction, Labor and Industries, Public Safety, Public Utilities, Military, and Agriculture.

Each department is divided into a number of smaller departments each of which is in charge of a director. In the Department of Education, for example, besides the department organization itself, there are three specialized divisions; the Blind, Public Libraries, and Immigration and Americanization. The members of each of these divisions originate action to separate groups of persons. Not only is there a complex set of relations within the Department of Education, but furthermore, the members of this department originate action to the members of the school system which is a part of the local political institution and of the public libraries of each city

and town. Each school system is made up of a school committee, which selects a superintendent of schools, and he is the sole member of Class B in the set. The principals of the various schools terminate action to the school committee and the superintendent, and originate action to teachers and pupils. The teachers terminate action to all these others and originate action to the pupils, who make up the class of those who only terminate action (Class C). The city, or town, school system forms a considerably isolated sub-system, since a large number of the events in the total school system involve the school committee and superintendent as originators. Nevertheless, members of the State Department of Education do visit the schools of a community and originate action, though with a relatively low frequency.

In other departments the frequency of interaction may be higher, particularly in departments such as those of Public Health and Public Welfare, where the hierarchy is concerned with restoring disturbances in equilibrium. In Public Health, for example, where occasional epidemics upset the equilibrium of many institutions, such as families, schools, and economic institutions, by markedly changing the habitual rates of interaction, the frequency of origins and the amount of interaction are much higher and increase as a function of the changing interaction rates in cases of disequilibrium. In Chapter 18 we shall discuss several cases which show how the state of equilibrium in one institution may be restored after a disturbance by changes in the interaction in other tangent institutions. Thus in the case of a severe epidemic the disturbances in interaction rates due to illness are compensated for by a marked increase in the interactions of the State Department of Public Health with the city and town Departments and the members of the affected institutions. This continues until the disturbance has lost its force and the interactions return to their normal rates.

As in other hierarchies, the development of supervisory sets, or any other set which is found within the institution, is determined by the requirements of the system in maintaining itself in equilibrium. Where activities and techniques last for a short period only, as in a simple society, the development of any political institution is to a large degree dependent upon the presence of individuals who have a high origin rate and who build up a set in which they originate action to one or more classes of followers. In many cases such a set of relations may be temporary, lasting only while the group is on the warpath or on a hunting expedition. In any case, it is largely dependent for its existence upon the single individual, the Mumi, and tends to break down upon his death. Only when the stresses in the relations of individuals become continual do we find the development of stable sets of relations to which the individuals are habitually conditioned,

which are a necessary element in maintaining the society in a state of equilibrium.

In the development of complex hierarchies, in Peru, in the United States, and elsewhere, the sets arose as a mechanism to stabilize the interactions of the individuals. Thus among the Inca, aside from the daily supervision of those immediately under him, the duties of an intermediate member of the supervisory set included making monthly reports on the immediate administrative situation to those above him. On the basis of these reports, events increased down the line, and a continual process of adjustment went on, within the limits of which the system remained in equilibrium. If we study the literature describing the activities of the departments in the Commonwealth of Massachusetts, we find that there are statutes which set forth what individuals shall interact and how often these interactions shall take place. The vast body of legal material which has arisen in the interpretation of these statutes is an attempt to fix even more precisely the exact order in which individuals shall interact, who shall originate to whom, and how often and under what circumstances.

In complex societies, two developments occur as the specialization of political institutions increases. The first is the rise of courts, and the second the development of a representative system.

Courts. When events take place in any group which upset the equilibrium, some compensatory events occur which lead towards its restoration. We have already seen, in the discussion of conflicts, how disequilibrium of this sort comes about. Two persons who do not habitually interact begin to originate to each other, and from this interaction a new set may begin to develop. As a mechanism whereby the balance in the order of action in the old system may be restored, compensatory origins take place. Even where individuals have been in interaction, a change in their interaction rates disturbs the equilibrium and brings about compensatory changes in their relations. When conflict situations arise between two groups, the series of changes that take place tending toward equilibrium are called feuds or wars. When they occur between members of a group within a single institution, they become crime.[7]

In simple societies, the punishment of a crime is usually undertaken by the aggrieved party, and such individuals as he can rally around him. But ordinarily, these adjustments take place under the direction of the head of the family system. If a murder or serious injury occurs within a group, adjustment takes place between the members of the group under the direction

[7] Crime, as used here, means both torts and crimes, in the legal sense. The distinction will be made in Chapter 28.

of its habitual leader. Thus the chief of the clan adjudicates internal disagreements, and quarrels between members of two clans will be discussed and perhaps settled by the two leaders.

In most political hierarchies, a large part of the interactions within the sets consists of restorations of equilibrium between members of a single class by their interacting with one or more members of a higher class in the set. A quarrel between two individuals which begins to disturb the relations of other individuals in a system may so disturb one of the other persons that he originates to the chief, asking him to intervene. This is a pair event which is followed by a set event, or sequence of set events, in which the chief originates action to all the participants in the quarrel. Often he may intervene and originate action without an appeal taking place. In most societies, even in some of considerable complexity like the Inca Empire, the settlement of such disturbances takes place within the supervisory set, and there may be a well-developed routine of appeal, involving pair events from individuals on one level in a set to an individual in a class immediately above. A village chief's decision may be appealed to a district chief, and that in turn to the king, or paramount chief of the tribe. Within such a system, however, individuals may arise who act under the direction of a chief and execute the commands of the head of the set.

The simplest case, of course, is that in which the head of a set orders all the men under him to carry out a judgment. In Australia, for example, the elders, as a body, lead the culprit away from the camp and kill him. Among many peoples, however, special persons act as executioners. Among the Galla, when a chief orders an execution, the executioner is selected from an outcast group of hippopotamus hunters called the Watta, who live among the Galla. The Watta are not connected by kinship to any of the Galla groups, and, therefore, the chief who employs them does not become involved in a feud because he does not actually kill the man himself. Among the Omaha, we saw the development of a special class of soldiers, who on the tribal buffalo hunt, carried out the commands of the leader of the hunt, and on other occasions were under the direction of the Seven Peace Chiefs. These soldiers were very much like our police, but unlike the latter, they constituted a single class immediately under the leaders of the whole political system. In an American city the police are members of a single sub-system among many other sub-systems within the whole political organization.

In many communities, where no elaborate hierarchy with a strong supervisory set has been developed, private individuals may frequently act in adjusting disputes. Among the Ifugao, individuals called "Monkalaun" settle disputes, arrange marriages and act as intermediaries in many situations. In

Ethiopia, two litigants in a dispute will call upon some stranger whom they meet on the road to stop for a while, hear their arguments, and decide between them. Some men attain a reputation for impartiality and good judgment, and are called on frequently for this purpose. In many parts of Negro Africa, a definite system of courts has arisen in which the chief, or council of chiefs, acts as the judge. Each rank of the supervisory set forms a court to try those beneath it, but the individuals are not specialized in this respect, for they do not act solely as judges. In more complex societies, individuals arise who are full-time specialists in judging, and who thus form special departments of the government, since the amount of interaction in which one individual is able to take part has definite limits.

In a number of Moslem countries, where there is no strong central government but each clan or tribe is more or less independent, there are individual judges to whom members of different clans or tribes can come to have their disputes adjusted. These judges, called "Kadhis," do nothing but hear cases and live by collecting a fixed fee from each litigant. They observe a scrupulous impartiality and do not accept bribes, for once they fail to observe these rules, they lose their clients. The sets which they form with their clients go beyond the limits of the local political systems, which they serve to keep in a state of mutual adjustment.

In countries where the supervisory set is stronger and the political system as a whole more complex, as in the United States, judges form part of the total institution. Here there is also a division of labor. Instead of a single judge, we have judges presiding over courts, court officers, policemen, lawyers, jailers, executioners, and others, all of whom form a sub-system which is part of the state as a whole. In the more complexly organized kingdoms of Negro Africa, such as Dahomey, specialized judges and lawyers also developed. In Chapter 28, we shall discuss the differences between these various systems and the ways in which routine procedures have arisen, not only to establish the order of events between individuals and the frequency with which they are to occur, but also to set up precise orders of action within the events themselves, by such mechanisms as technical legal phrases.

The Representative Form of Government: Democracy. So far we have been largely concerned with the operations of the external relations, supervisory, staff-line, and processing sets. Where individuals have developed a stable equilibrium in all their institutions, the increase of frequencies in the supervisory set, due to an increase in the external relations sets, requires a compensatory mechanism to restore the equilibrium without changing the system. This is provided by the representative set in which those who are

supervised originate to those who supervise them. It characterizes what we call the democratic, or representative, system.

In societies where this set is found, the members of the supervisory set are elected by the persons whom they govern, unlike the situation found in the many societies where positions are inherited, or where the lesser officials are appointed by the head of the state. In a system of this kind, where the administrative hierarchy is made up of several classes, the members of the entire group, comprising all the classes, select the members of each class in the system.

Thus in early New England, the adult males in a community chose their representatives to the General Court, or state legislature, and these in turn selected representatives to the Continental Congress. In some instances there was an intermediate step in which the members of the town meeting elected selectmen, and the selectmen chose the representatives. When such a system was set up, the voters of any community might frequently originate action to their representatives by petition or memorial in which they stated their desires on some piece of legislation. Thus the voters of the town, at the town meeting, might request the selectmen to ask their representatives to bring such and such matters before the legislature. Not only was there a continual series of events between voters and their representatives, but also, by limiting the period for which the representatives served, the voters were able to make the representatives respond to their origins through fear of losing their support and thus failing of reelection. Control over the representatives, of course, varied to a large degree with the ability of the voters to compel their representatives to respond to their origins. In this country the representative system is based on a fixed term of office, and this is also found in many complex tribes, such as the Galla, where there was a four-year term, or among the Mandan, where one chief held one office during the winter, another during the summer. In other cases leaders are elected to offices for life or good behavior, and even in societies where chieftainship is hereditary, the chief's assumption of office usually has to be confirmed by the response of his constituents. In such a case, however, it is not correct to say that the representative set exists, because the so-called "election" which often takes place is not an origin of action on the part of the people but rather a termination to the man who inherits the office. If the members of Class C fail to respond to his command, then some other individual among those eligible for office tries to originate to them, and the successful one is the one who evokes their response. This is the same procedure that we saw in the case of Songi when he became Mumi.

Representative government is not rare in the world, and is found at

various levels of institutional complexity. Some of the best examples are those of the Riffians and of other Berbers, and of the Turkish peoples of Central Asia and Siberia, especially as exemplified by the Yakuts. In the case of the Riffians, each valley or other geographical unit which includes two or more clans has its council, the Asht Arbain, which includes members chosen from each clan by its older members. These councilors come together whenever there is any business which concerns the area which they represent; that is, business between members of their clans. They pass judgment and exact fines and retribution from culprits, in cases such as misuse of irrigation water, theft of animals, and minor personal injuries. In case of murder, however, the councils from the entire tribes assemble in front of the house of the murderer, and pass judgment on him there. This is an event which will disturb the equilibrium of a large number of people and, therefore, their representatives come from far and wide to settle the matter and prevent the outbreak of a feud, which might spread, through tangent relations, over a wide area. The representatives sit in a circle, with their moderators, or spokesmen, in the middle. Before the moderators make a decision each one confers with his councilors, who are sitting immediately behind him. When they have decided on the penalty, they give the blood-money to the victim's family, to keep them from killing someone else in return, and divide up the fine between the local councils. Thus the clan of the aggressor has to pay the rest of the tribe for its breach of equilibrium, which, if the meeting is successful, is restored. Among the Yakuts, almost exactly the same procedure takes place; in times of crisis the related clans come together and form a similar circle of councilors, with clan leaders in the middle. However, in this case, they have an outer circle, composed of the individual clansmen sitting behind their representatives. Thus the three classes in the system, A, B, and C, are graphically represented by the position of their members on the ground, and the workings of the representative set may easily be witnessed.

The Circularity of Origins in a Democratic System. In any democratic system, two elements are characteristic and significant: the circularity of origins of action in set events, and the high frequency with which these events take place. The first of these may be explained as follows. The individuals who are in Class A of the supervisory set, that is, the executives or administrators in the political system, are also in Class C in the representative set. It is true that the frequency of events in the representative set must be lower than that in the supervisory set, if the system is to operate; nevertheless, the existence of such a compensatory mechanism enables the individuals who are being administered to restore their equilibrium under con-

ditions of too great administrative activity by increasing their origins and thus forcing a reduction in interaction in the administrative set.

As the system works in the United States, the lower officers in the administrative set are appointed by the higher officers, while the latter are elected by the voters. For example, we elect a Congressman and two Senators as well as the President and the Vice President. The latter two are the heads of the administrative set, but the Congress originates action to the President, who is their executive officer, just as the school committee originates action to the Superintendent of Schools. The administrative system, of which the President is the head, originates to us, common citizens; but if its origins are too frequent, we can originate action to our Congressman, who can originate action to the President or any member of the administrative set. We can also originate action to the courts, and they in turn will originate action both to the administrative hierarchy, of which the President is the head, and to the legislature.

This system, within which actions are originated in a circular manner, provides the checks and balances which characterize our constitutional government. Its effectiveness, however, lies not merely in the fact that these mechanisms have been provided for, but also—and this is equally important —that *the frequency of events in the representative set is comparatively high.*

Other societies have copied the American constitutional system, but the resultant differences in operation have been consequent upon the fact that in every stage in our political system—which has not been the case elsewhere—this combination of sets has been present. The New England town meeting, for example, represents the most complete development of this system, for here all officers are elected by the voters. In the cities, as well as in the state and federal governments, the number of appointive offices has been far greater, and at the same time the classes making up the representative set have necessarily become greater, due to the larger number of people administered. Here representatives elected to the city council or the legislature in turn elect the members of the committees which supervise certain departments within the administrative hierarchy. These committees, however, are still responsible to the voters through the mechanism of hearings which they hold to consider any questions that may arise. Interested voters may attend these hearings, which serve as a substitute for the town meetings held in smaller communities, in which the citizens originate to the selectmen and other town officers.

The Equilibrium of Institutions. Every institution, political or otherwise, must necessarily work out an equilibrium, if it is to survive. This equilib-

turbances of equilibrium, and also to build up leaders. When a change is proposed in a department's policy, the general subject is discussed at a local board in the county. Recommendations are finally agreed upon, or differences of opinion made clear, and this information is passed on by department agents to the state supervisors. They in turn hold meetings at which they are supposed to be present as onlookers, and the suggestions of the county meeting are discussed and recommendations made to a policy-planning committee in the Department of Agriculture. In the light of their recommendations, the Department agents draw up a program to which the executives in the Department tentatively agree, and this is then sent down the line for further discussion and criticism. Only after the groups of farmers have finally acted on it does it become part of the administrative policy.

By this method the Department has developed a scheme which places the people who form Class C in the supervisory set in a position from which they can originate action to the administrators. This scheme, therefore, is an extension of the workings of the representative set, by which compensatory movements can be initiated within the political system. Unlike many usual procedures, such as the naming of advisory committees, it provides for a complete extension of the representative set to all individuals who are administered, that is, to the total personnel of Class C.

The Democratic Process. The democratic process, therefore, in which we are justly confident, is not merely a formal system of relations like the authoritarian government of the Incas, or the totalitarian "ideologies" which have arisen of late in Europe. It is a system characterized by a high frequency of interaction in the representative set. It is what Abraham Lincoln called "a government of the people, by the people, for the people."

The Inca system of government endured because there were no outside forces to threaten it, nor any important technological changes. When Pizarro and his Spaniards came, it almost immediately disintegrated. The totalitarian governments of Europe can endure only as long as they are winning on the battlefield, only as long as the members of Class C in the supervisory set can originate at a high rate of intensity to outsiders and thus maintain their equilibrium by compensating for the high rate at which they have to terminate in the supervisory set. The democratic governments, of which the United States is the oldest and most outstanding example, are so constituted that they can weather adversities of warfare or technological changes which would destroy the equilibrium of others. Compensatory movements are provided within the system through the mutual dependence of the supervisory and representative sets.

SUMMARY

A political institution is a system in which individuals who are members of different families, and in complex societies other institutions as well, respond to the origins of a leader. In its simplest form they may consist of a band of food-gatherers who require leadership only occasionally when crises arise to disturb their interaction rates. By responding to the origins of a leader they are able to build up their frequency of interaction in a set with him at the top, so as to resist the pressure from outside. Such a leader is a person who not only has a high origin rate in set events, but a great elasticity of origin rate, so that it will increase more rapidly in emergencies than those of others.

Every political institution includes a *supervisory* set, from leader to followers, and also an *external relations* set, in which the leader also originates to outsiders. Every political institution is associated with some part of the landscape, and has its "country." As techniques improve and trade increases, as people begin to interact farther afield, these small countries tend to come under a single leadership, and become provinces, counties, or departments of the government.

In simpler societies political leaders work at the same tasks as other people, but as crises arise more and more frequently and the leader has to spend more and more time originating in the supervisory and other sets he must be supported by gifts from his people. This is the beginning of taxation. The leader obtains more gifts and taxes than he needs personally, but distributes them among his followers in turn and uses them for state expenses. He thus acts as a clearing house for materials, taking them in singly and handing them out in set events, and this is an important way of maintaining the equilibrium of the system.

Political institutions regulate interaction in conflict situations, if these develop into warfare. Warfare is the result of a failure of groups to adjust to one another. In some societies wars take place every year at a given season, and these expeditions serve to keep the population down, to establish the political hierarchy in terms of the supervisory set, to initiate the boys, and to establish rank. Thus warfare provides the basic framework for the entire organization.

In most societies the majority of males will become warriors when crises arise, but in complex states there will also be a separate professional army. In such cases the army is a separate sub-system under the authority of the head of the state. Elaborate armies constitute the most highly organized institutional systems known, and have a very high frequency in the super-

visory set, i.e., strong discipline, because the soldiers must be trained to originate to the enemy under conditions of great stress, and because of the requirements of maneuvers. The complexity of an army depends to a large extent on the technology of the people; it would be impossible to have such divisions as tank corps, air corps, infantry, artillery, etc., without complex machines.

In complex societies civil and military hierarchies have different personnel. This is associated with differences in the relative frequency of the sets in the system. In the army the supervisory and external relations sets are strong, in civil life all sets, including the staff-line (between departments) and the processing (between individuals performing different parts of techniques) are more or less equal. In the army, furthermore, the soldiers interact little outside their political sub-system, in civil life people interact in other institutions, including the family, at a high frequency as well.

Complex civilizations require complex political institutions, with staff-line and processing sets highly elaborated. All of these sets develop through the requirement of the system to remain in equilibrium, to stabilize the relations between individuals, most of whom are specialists and whose techniques and also interactions are complicated. Two special developments aid this stabilization; the *court system,* which serves to maintain equilibrium by removing or changing the interaction rates of persons who cause disturbances, and the *representative system,* in which the members of the terminal group in the administrative set are able to select their leaders and to originate to them through representatives whom they have also selected and by direct petition. Representative government does not occur in all complex societies, but when it does it is the most effective kind of all since it provides the most stable adjustment for all individuals through the compensatory action of its representative set, and hence it is the most flexible.

CHAPTER 15

Economic Institutions

I. THE DEVELOPMENT OF SIMPLE ECONOMIC INSTITUTIONS

In the simplest societies, technological activities within the family take care of almost all of their requirements. With the exception of a very few objects, the individuals can produce what they need to continue their adjustment to their environment. These few needed objects, however, are ordinarily obtained through trade, and in this very simple form of commercial relationship we find the beginnings of economic institutions. We have already studied in Chapter 11 the occasional meetings of bands of Andamanese, at which they exchange products, and the silent trade practiced by the Kubu and Lubu of Sumatra. In both of these cases the interaction between Class A (the band or family) and Class C (the customers) is so intermittent that no permanent institution exists.

A more complex situation is found where technical processes involving sets are associated with trading activities outside the family. Among the Siwai of Bougainville the sago is prepared for the Social-Climbing Feast by the following process (described by Oliver) which we have already discussed in Chapter 14. A group of men from the different villages and families taking part in the feast cut down the sago palms. The following day the work-group begins to prepare the sago for food. Some of the men, who are designated as shredders, remove the outer woody shell from the pith in the center of the trunks, and chop up or "shred" this pith into small units. When enough pith has been shredded for a beginning, the "washers" then set about washing it, to separate the starch from the fibers, and when they finish with a lot, they hand the starchy residue to the "packers," who compress it into leaf packages.

In this instance the process of preparing sago for cooking includes several steps. One man could do them all alone, but when they are divided among several men the work is speeded up and relatively greater quantities of food are produced. The same is true of the technique of Buffalo Hunting among the Omaha, described on pages 151-152, in which some men act as police, others as hunters, and others as meat-cutters, all under the direction

of the Leader of the Hunt. In both of these cases the elaboration of a technique brought about the development of a processing set in the political institution through the mechanism of the division of labor outside the family. Neither set was of a very permanent nature. Sago-making lasted only as long as it took to prepare for this particular feast, and when another was given, the personnel might well be different. The buffalo-killing set lasted for only a few weeks each year.

The simplest systems of production which are based on manufacturing are found in cases where an individual or a group, usually a family, make articles which one or more individuals then offers for sale. In many cases this activity, like those mentioned above, occurs but intermittently, within the lines of authority of one of the sets within the family. The economic institution which results is comprised of the set of relations from salesman to customers (the commercial set), and the family is tangent to this institution through the salesman. The equilibrium which results is, however, made up of the adjustment in frequencies between these two systems.

In New England, fifty to a hundred years ago, farmers and fishermen used to make shoes in the winter, and very often the whole family would be engaged in the process. The completed shoes might be taken to town to be sold by the father, or in a more complicated system, a storekeeper would come around in a wagon to collect the shoes and leave leather and supplies with which to make the new ones. In these family situations, the technological procedures of manufacturing for sale increase the frequency of events in the family, and, as we saw in Chapter 12, might even introduce changes in the family system, consequent upon increased frequencies in the sets or between the members of working pairs. This kind of situation is found not only in small family groups but also in extended kin groups, such as clans or large families in many parts of the world. In Tikopia, for example, the chief of a clan directs agricultural activities, the building of canoe sheds and canoes, and the construction of seine nets, and in general clan leaders direct the technological activities of their kinsmen.

In some areas there is an interesting transition between part-time and full-time family manufacturing, which is dependent upon the degree of adjustment which can be obtained in their other activities. In the Rif, for example, where the majority of the population are farmers, home manufactures are used for the family's own consumption, and surplus articles are placed in markets for trade. There is a difference between objects made by men and objects made by women. The women use the simpler techniques and make mostly for home consumption; they make handmade

pots to be sold in local markets, and cloth on a one-bar, suspended loom, again for the local markets. The men make a better grade of cloth, which is used for men's clothing, on a two-beam loom with mechanical heddles and shuttles. When surplus articles have been accumulated the head of the family either takes the material to market himself or appoints one of the other members to do so.

In the high, thickly forested mountains of the western Rif, where the land is very steep and the winters long and cold, with much snow on the ground, there is a marginal area where farming is very difficult and does not yield enough food to support a population of any density. The tribesmen of Taghzuth, however, who live in the center of this area, have developed a full-time system of manufacturing which makes up for this difficulty and permits a relatively large population, using local materials. They make many kinds of objects out of wood, which is plentiful there, and also of leather, which they can tan with the abundant local supply of oak bark.

In some instances this manufacturing is carried on entirely within the family, but larger enterprises have also been developed which are, in effect, manufacturing shops, each of which is run by a *Malim* (master) and his apprentices, who are not necessarily kinsmen. In this way another set, the administrative or supervisory, is formed. This second type of organization develops out of the simpler family type when the demand for the product increases. For example, Taghzuthi pocketbooks became popular in France and the United States during the late 1920's, and the mountain craftsmen were stimulated to produce as many of them as possible. In this instance, the increase in frequency of the commercial set brought about the rise of a complex economic institution based on a specific manufacturing process.

Techniques and the Family. We have already seen how family systems have developed, and how political and religious institutions have grown out of them by the process of extending their personnel beyond the family itself. The same is true of economic institutions. Many of the techniques which were described in Part II are carried out in all societies by members of family groups, and in the simpler societies most, if not all, technical activities are performed solely within the bounds of kinship.

In its most limited form, a simple society consists of small family groups combined into bands, hordes, or villages, occupying individual territories, and carrying on all necessary techniques by themselves. As these groups become more complex, owing to advances in technology or to other reasons, there is a tendency for clans, tribes, and other extended family units

to develop, and within these units may be found sub-systems where technology plays an important part in maintaining the interaction. True complexity arises only when other institutions outside the family come into being, and these depend upon the development of specialized personnel drawn from different family systems, through the rise of a division of labor and an increase in trade.

Economy, Economics, and Economic Institutions. In Chapter 12 we have stated what we consider to be the distinction between institutions and tech-

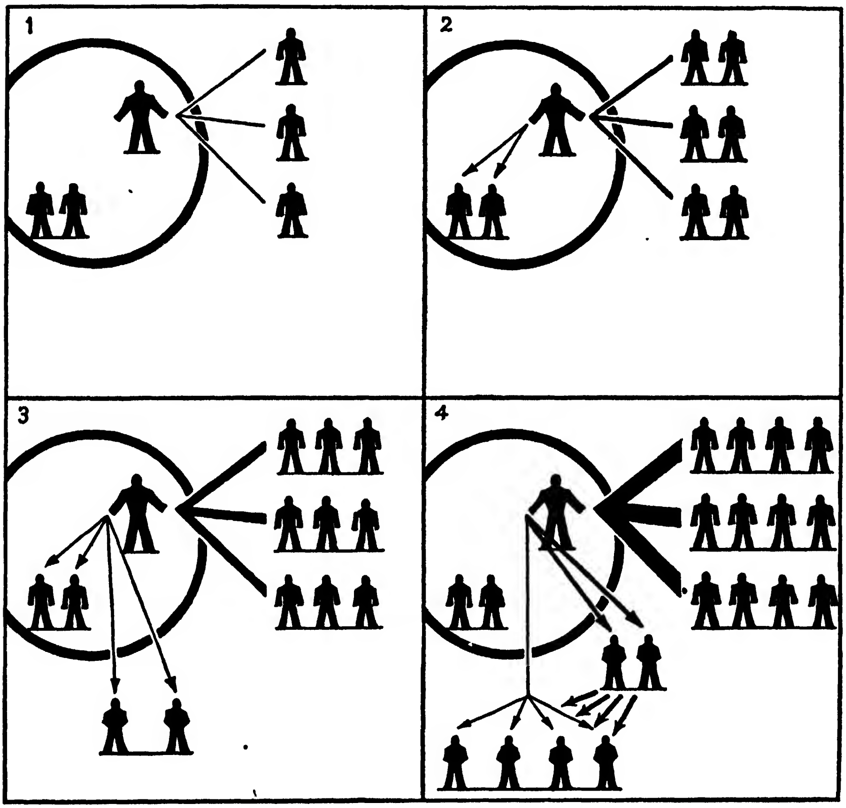


FIG. 8. THE RISE OF A SIMPLE ECONOMIC INSTITUTION: TAGHZUTH

(1) The craftsman sells to a few customers. (2) As the volume of his business increases, his sons begin to work under his direction. (3) With a further increase in sales, he employs apprentices outside the family. (4) With a larger volume of business, all the manufacturing is done outside the family, and a factory hierarchy develops with foremen supervising the workers under his direction while he continues to sell directly to customers.

For key to symbols, see Figure 3b, page 284.

niques, but it may be well to carry this a bit further in reference to economic institutions and the techniques of getting a living. There is considerable confusion over this point in the literature, and many anthropologists use the terms economy, economic, and economics loosely or interchangeably.

The noun *economy,* for example, is sometimes used to mean frugality, or lack of waste, at other times to mean the system of techniques used by a people. As we have stated in Chapter 10, we are using the word *technology* in this book to cover the latter meaning. The adjective *economic* is used here to designate economic institutions and not the so-called "economic" techniques, since, as we have shown in Chapter 12, most techniques are used in all institutions, and there are no techniques which belong exclusively to one or another. An economic institution, therefore, is defined as a system of relations based upon the *Commercial,* or seller-to-customer, set, in which the members of any supervisory or processing set are not coterminous with members of the family.

When two brothers go out to chop down a tree under the direction of their father, the interaction occurring in this technical operation, is, as we have seen in Part II, a part of the technology of their group, and it occurs within the family system. If, however, these two brothers are working for a lumber company under the direction of the company foreman, although they may cut down the same tree with the same tools, in precisely the same way, they are in this case interacting as members of an economic institution.

The noun *economics,* like *politics* and *religion,* refers to the totality of activities associated with economic institutions, as politics refers to political, and religion to religious institutions. Since these words are capable of ambiguity, we shall use them as little as possible.

Quantitative Characteristics of the Commercial Set. Although, as we shall see, individuals in other sets in economic institutions differ little in their interaction rates from the members of sets in other institutions, there is considerable difference in the relations forming the commercial set. The seller is endeavoring to obtain as many customers as possible, but the events in which he interacts ordinarily occur with a relatively low frequency. Although in the case of food shops in places where a population buys rather than produces most of its food, the interaction will ordinarily take place daily, most purchases occur much less often. Because of this, therefore, the stability of the relations is much less than that existing, say, between a political leader and his followers. A newsboy shouting on a city street corner, to take an extreme case, originates to many people, but the

people who terminate in these set events do not represent any fixed group, particularly in a large city. These responses, which consist of listening to the cry and perhaps buying a paper, are very short and occur only once or twice a day. It is hard for any organized set to develop in this case, in view of the differences in the hours at which people go past the vantage point.

Even in stores and hotels, the repeating customers, i.e., those who constitute a permanent clientele, form a relatively low percentage of the total. People shop around, and the actual transactions carried on by any economic institution depend more upon the volume of contacts than upon the mutual relations of a single group of individuals.

In cases of certain types, however, the commercial set is not so unstable. This is where one economic institution is a customer of another. Here long-lived relationships are more nearly the rule, due to the technical requirements of providing the same type of goods for the final consumer. In the grocery business, for example, S. S. Pierce Company of Boston has bought food from some of its suppliers for over seventy-five years, and, on the other hand, the families of some of its customers have been trading with them for the same length of time.

Executives of business concerns like to make their clientele as stable as possible. That is why they often encourage charge accounts, and in some cases get their clients deliberately in their debt so that they are permanently bound to the company in a form of peonage. In rural Ireland, a storekeeper is distressed when a client pays his bill up in full; the act is taken as a sign that the client intends to shift to some other merchant. Publishing houses will sell subscriptions to magazines at a lower rate than the newsstand cost. By stabilizing their clienteles in these and other ways, business concerns are able to establish equilibrium in their systems. Where the customer class is extremely variable and transitory, the institution is more likely to have its ups and downs in volume sales, with consequent repercussions on the staff itself.

The special requirements of the commercial set, in order to produce interaction with as large a number of individuals as possible, have brought about the selection of a particular type of personality, that of the salesman. Individuals of this type have a high origin rate and a capacity for relationships in which the frequency of events is relatively low, though the interaction rate during each particular event is high. The salesman type of personality is found in economic institutions in all societies, but in complex civilizations like our own in which elaborate hierarchies develop within economic institutions, leaders are necessary as well, and the leader need not necessarily have the special type of interaction rate of the salesman, as well

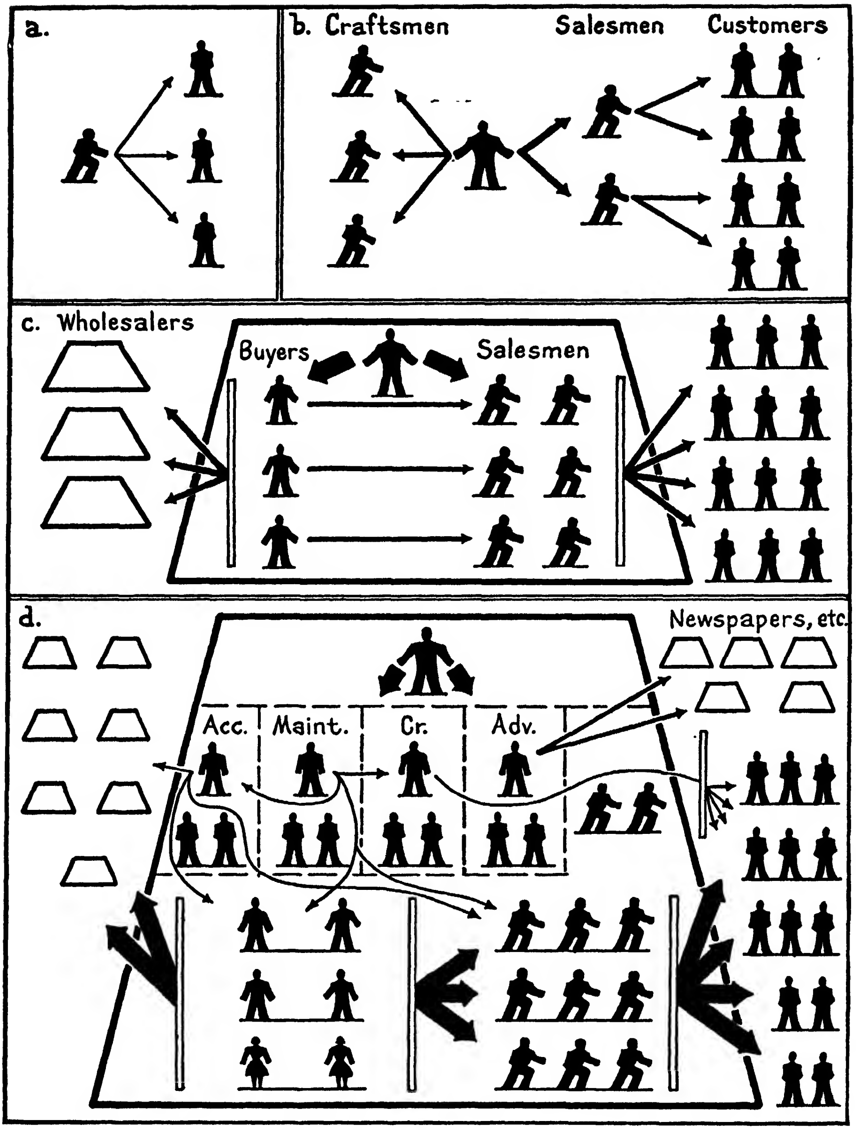


Fig. 9. The Rise of a Complex Economic Institution: A Trading House

(a) A merchant makes his own goods and sells them in market. (b) As business increases, he buys goods from other craftsmen and markets them through salesmen. (c) He now assembles a staff of buyers and salesmen; his goods now come from wholesale houses. (d) As volume of business still increases, a complex economic institution arises, with Accounting (Acc.), Maintenance (Maint.), and Advertising (Adv.) staff-line departments, besides the basic commercial staff, divided into its departments. The complexity of the institution is a function of the volume of interaction.

as his characteristics of leadership, since he can hire others to do the selling for him. In the simpler societies, however, the trader or shopkeeper need not be a leader as well; he is usually a salesman of the unspecialized variety.

II. THE DEVELOPMENT OF COMPLEX ECONOMIC INSTITUTIONS

Elaborations of Trade. We have already discussed some of the simple examples of trading relations—those of the Andaman Islanders and of the Lubu and Kubu of Sumatra, as well as the Riffian example just given. We shall now see how this relation between seller and customer builds up complex institutions in many societies. One way in which trade is developed in many tribes is through partnerships; that is, an individual of one tribe has a trading partner with whom all barter or exchange takes place. These trading partnerships are perhaps best known in New Guinea, where they are associated with the exchange of ceremonial objects in the *Kula Ring*.[1]

In southeastern New Guinea, and in the Trobriands and adjacent islands to the north, there is a widespread system of exchange which represents a very large economic institution. Around a definite route from island to island and to the mainland, two types of ceremonial objects move in opposing circles. Each individual who is wealthy enough to interact in the Kula system has one or more trading partners in adjacent communities. From one direction he will receive necklaces of spondylus shell, from the other he will receive shell bracelets. The partners pay each other reciprocal ceremonial visits during each of which one of these objects will be exchanged. This ceremonial exchange system serves as a framework for a more important, although less spectacular, exchange of all kinds of goods manufactured on different islands. For example, one of the segments of the Kula Ring is the Amphlett Islands, which serve as the principal source of pottery for the whole region. Besides pottery, the Amphlett Islanders export turtle-shell earrings, ocher, rattan, and feathers from the cassowary and red parrot. In exchange for these objects they receive imported foods, such as sago, coconuts, taro, yams, betel nuts, and pigs, none of which can be grown in sufficient quantity on their own islands. Since these islands are coral reefs, they also lack stone suitable for polished implements, and hence they received this in trade from the volcanic Trobriands by way of Woodlark Island. They actually received more of this implement stone than they could consume, and traded what was left over to other islands, along

[1] Malinowski, B., *The Argonauts of the Western Pacific*, London, 1935.

with a continual flow of wooden dishes, baskets, lime pots, and other objects.

Ordinarily these exchanges of special products took place on big Kula expeditions, when a number of traders went along with a Kula partner on his ceremonial visit to a neighboring island, or part of an island. This Kula Ring was so extensive in area and involved so many people that none of those who took part in it understood all of its ramifications. Nevertheless, the practice of Kula partners making periodic visits for trading as well as for ceremonial exchange maintained the system in a state of equilibrium.

The Development of Markets. In many parts of the world, people habitually meet at regular intervals in order to trade. As the frequency of these meetings increases, they form the habit of meeting in fixed places. Once an arrangement of this sort has been made, markets develop in which goods are regularly bought and sold and individuals are able to build up a more or less permanent clientele. Markets of this kind are often located on the boundaries between villages, or at crossroads along important arteries of traffic, and many of these crossroad markets have, in Europe and elsewhere, developed into towns and cities. There are several steps in this process. First the people come once a year, month, or week on fixed dates. As the same traders come back again and again, they build up small permanent booths and enclosures, and eventually shops. As the volume of trade increases, the market finally keeps open every day, and the traders live there permanently. Craftsmen are drawn there as well, and specialists in transport. From this point on, the market becomes a part of the town, instead of the town being an adjunct of the market.

An intermediate stage in this process is found in most of the country districts of Morocco. In the Rif, for example, every canton has a weekly market, and the days and locations of the markets are so correlated that it is possible for a person living in almost any place to reach a market on foot and walk home again the same day on any week day except Friday, the Moslem Sabbath, on which no markets are held. The most important and hence the largest markets are always held on Thursday, the day before the Sabbath, when the Riffians do their equivalent of our "Saturday night shopping." Thursday markets are usually thronged with people, and they afford opportunities for much interaction between people from the neighboring valleys. Everyone is required to leave his gun outside, and people are usually on their good behavior inside the market bounds, since this is the only place where clans who are at feud with one another can interact in safety, as well as the only occasion when many of the people interact at all with outsiders. Thus the market is a clearing house for news as well

as for goods, and an important mechanism for the maintenance of equilibrium.

Each market is divided into sections under the authority of a council, meeting in a special room or in a house especially built for it, and anyone who commits an offense in the market is brought to the council for judgment. Each section of the market is limited to the sale of a particular ware; all the cloth merchants are in one place, the butchers in another, and the women selling pottery in a third. Farmers bringing in cattle or sheep and goats turn the animals over to the butchers, who slaughter them for a fixed fee, and the owner of the meat then offers it for sale. There are two paid officials in the market: the market-crier and the official weigher or measurer, who are hired by the councilors, the political officers of the tribe. The market-crier and the official weigher are always outsiders; they are not even Riffians. They are brought in for this purpose, since they have no family affiliations and cannot cause feuds through accusations of partiality. In this respect they resemble the Watta executioners employed by the Gallas.

Besides the regular markets, there are also women's markets in the Rif, from which all men are excluded. The men are kept in partial ignorance about what goes on at these markets, but it is well known that the women sell agricultural produce and particularly the manufactured objects which they make themselves, such as pottery. They also dispense magico-medical materials, some of which are used as contraceptives and abortives, but since the men disapprove of this, it is not easy to obtain exact information. The fact that the women are able to hold private markets of this kind indicates the strength of the female set of relations in the Rif, where women originate to men much more than in Arab countries.

The weekly market is a characteristic feature of all North Africa and the Near East, and of many European countries as well. In New England, the Saturday night market was long an important fixture. Farmers brought their produce in and sold it from wagons, peddlers set up stands, and others walked about with pushcarts and trays. Many of the farmers backed their wagons into the same places year after year, and the peddlers also kept the same positions. Such a market can still be seen in Boston, where it is now operated and patronized chiefly by Italians.

Another important type of market which is indigenous to Europe is the great annual fair, held usually at harvest time. A very famous one is the Leipzig Fair in Germany. Others are the cattle fairs in Ireland, where the farmers sell their cattle. Our own state and county fairs with their exhibitions of prize cattle and prize pumpkins, their sulky racing and peep

shows, are outgrowths of this market system which grew up originally as a means whereby farmers could dispose of seasonal surpluses of materials.

The Trader and His Clientele. Although in many cases the clientele of shops may seem to form a rather haphazard set of relations, recent studies have shown that, with the exception of our own department stores, shops are very tightly worked into the social system. In some places, as in rural Ireland, the shop may be a family corporation with husband and wife acting as shopkeepers and sons and daughters as shop assistants, although ordinarily one or more assistants may be non-family. In the system of retailing which is found in Ireland, the country store obtains a large part of its clientele from the shopkeeper's extended kin among the rural farmers.

When the ownership of a farmer's land is turned over to one of the sons, the other sons have to leave the farm and get some other job. One of the ways in which this is done is for a farmer to apprentice his son in a shop, so that he can learn the business and ultimately set up a shop of his own. The advantage to the storekeeper is that his apprentice's relatives in the country will come and trade with him. Moreover, if the shopkeeper wishes to keep the store going in a land where the family system is of such importance, he may see to it that his son marries a girl from the country and thus make sure that he will have a clientele for his store. As the son of a storekeeper said:

> If you want to get married, there is nothing in it at all but to look out for a country girl. If you don't want to make a fool of yourself and go in for politics, you have to depend upon your friends and your wife's friends, and if you can, you've got to marry a girl from the country. Then she'll bring in all her people from miles around with all their relatives and their married families, and they are the ones that'll buy your flour and sugar and tea.[2]

As Arensberg shows, if the shopkeeper's son builds up new relations and goes away to college, the changes in his system of relations make it impossible for him to continue as a storekeeper. He has to achieve his equilibrium either within this country-town network or take up a new profession and a new way of life.

Not only do stores in the village build up a clientele which may or may not be largely related through kin, but also storekeepers have to build up relations with their sources of supply. This means that the storekeeper has to go to the town to buy his supplies, and also to purchase food from the agriculturists. As he gets more customers, his requirements become greater and his relations with people who sell him goods must become more

[2] Arensberg, C. M., *The Irish Countryman,* Macmillan, New York, 1937, p. 166.

frequent. When this occurs, we find the beginning of methods of finance involving the extension of credit, not merely by individuals in retail or wholesale activity, but in institutions specially organized to do this.

In some places, as in Kaisienkung village in central China, much of the retail purchasing is done by agents who act for the purchaser. This village is connected by water with a near-by town, and one or two agents' boats ply daily between the town and the village. If a villager wishes to buy something in the town, he gives his order and money to the agent, who makes the purchase in the town. Each agent has a fixed relation with a number of shopkeepers, from whom he makes all of his purchases. He gets no commission from his clients for his services, but he periodically receives gifts and entertainment from the shopkeepers. The same thing happens in cities in the Azores. In Horta, for example, a young man comes to the house of each of his clients every morning and is given the grocery list. He brings the food around noontime and presents his bill for it. He gets his commission from the shopkeepers and the men in the market rather than from his customers.

There is a long jump in the complexity of organization from the small shop, with the owner and his assistants, to the modern department store with its hundreds of employees. Such a development is the result of the machine era in which mass production became possible. In such a store the basic factor is the limitation imposed by the individual's capacity to interact. The salesgirl or salesman can only interact with a relatively small number of customers. As the number of customers increases, therefore, the number of salespeople increases also, and in the process of growth, a division of labor based upon size of the store and differences in merchandise becomes inevitable.

In the modern department store, merchandise is divided into different types in order to reduce the amount of time necessary for the customer to find what he or she is looking for, and each general division, whether it be kitchen utensils, hats, leather goods or jewelry, forms a department. Each of these departments is made up of salespeople under the direction of a buyer or assistant buyers, who are ordinarily responsible for purchasing the merchandise sold in their particular department from the manufacturers. Within such a department there may be further specialization, but ordinarily each salesclerk is able to sell any merchandise in his department. On this primary division into sub-systems an elaborate organization springs up. A process set, for example, runs from stockroom to salesgirl to cashier to mailing department. That is, each transaction in which a customer buys something involves the interaction of individuals in these departments. A

number of staff departments, so-called, are also in operation, and in these members of the departments originate action to members of the selling force, thus forming a staff-line set. The maintenance department employees may come around to repair a counter or a broken drawer while the bookkeeping department may object to the way the sales are being recorded. The administrative set, involving origins of action running from the manager of the store to assistant managers to floor supervisors to salespeople, represents another active set of relations. Yet all these individuals form part of Class A of the commercial set.

Even more complex organizations result when a number of stores are under a single management. The big chains with which we are all familiar, like Woolworth's, Kresge's, the Great Atlantic and Pacific, or W. T. Grant's, are made up of hundreds of stores, and in such a case the complexity of organization resembles that found in a political institution, with regional divisions having degrees of autonomy in operation and a complex system of coordinating departments at the central offices. This development was the final result of the development of mass production, because mass purchasing, which can guarantee steady production to large manufacturing enterprises, stabilizes the equilibrium of the factory much more than the small purchases of a large number of individual stores which come in irregularly.

Peddlers and Itinerant Traders. In almost all countries where any institutional complexity has arisen, one finds peddlers moving about, usually over fixed routes, selling goods at their customers' houses instead of waiting for them to come to a shop or market. Very often these peddlers are drawn from special groups of people, as we shall show in the next section. Whoever they are, however, one characteristic feature of their activity is that they are usually safe from attack. In Ethiopia, a Greek peddler could, in the days before the Italian conquest of 1935, go through the territories of the most warlike tribes alone with a couple of pack mules carrying his wares, and no one would harm him. In countries where it is hard for people to get the goods they want, it would be very poor policy to kill the man that brought them or to prevent him from coming.

In the United States, there are now few areas where people cannot get to stores, and the visits of the peddler are no longer as necessary as they were a generation ago. However, they are still profitable, since the peddler sells to individuals, particularly women, who stay at home most of the time, and the peddler may offer some women an opportunity for welcome interaction. At the present time, the peddler's technique of house to house visits, which involves originating action to members of the household, has been

taken up by many large manufacturers of household objects, notably the Fuller Brush Company, and by manufacturers of vacuum cleaners and other labor-saving devices. In this case, the salesmen within a given area are under the supervision of a district supervisor. The district supervisors are in turn directed by state supervisors, and the commercial set is made up of many sub-classes, all designed to increase the selling activities of these erstwhile peddlers.

Special Trading Peoples. In many parts of the world, local populations, usually located in unfavorable environments, have become specialists at trading and habitually leave home for this purpose, returning years later after they have made enough to settle down. Often they delay marriage until after their return. One example of this is the Soussis, Berbers from the Sous Valley in southern Morocco. They may be seen in every city in the country, wearing their characteristic blue clothing, sitting in tobacco shops and small groceries. Single families keep these shops up permanently; when one individual has made enough to retire, he will be replaced by a cousin or a younger brother, whom he takes in as an apprentice for a year or two beforehand. For this reason almost all of the Soussis whom one sees in shops are relatively young men.

In Algeria, the Mzabites, men from an oasis in the Sahara, take over the same office. In the East Indies most of the traders are either Arabs from the Hadhramaut, or Chinese. In the United States, one finds shop after shop run by Greeks and Albanians. Almost all the Albanians come from one town, Korçë (Koritza). In this town most of the inhabitants speak English, and the chief source of income is remittances from America, particularly from Massachusetts where most of the Korçëans have settled. Originally the shopkeepers from Korçe came home after they had made enough money, but disturbed political events have often prevented it. The Greeks go all over the world; one may find them trading in the most remote parts of Africa and South America. Many of them have, until recent years, been able to go home again.

The movements of these migratory traders and their trading activities are of great importance to us in understanding the changes which have taken place in the organization of many societies. They not only bring about a special equilibrium in their home lands as a result of their long absences, but they also introduce changes in the adjustments of the peoples among whom they trade. In the latter case, they not only introduce new techniques and new ways of interacting, but they often have much to do with far-reaching historical changes. Many invasions and conquests have been brought about through the agency of such people. Large elements in

the population of the United States came here first in this way, and then remained. It was Hadhramaut traders from Arabia who introduced Islam to millions of people in the Dutch East Indies and started the course of Malay conquests.

One of the most influential of all the special trading peoples in human history are the Jews, who went from Palestine to Europe, North Africa, Central Asia, and even China, at various periods, particularly at the time of the Roman Empire, when the equilibrium of their own state had been upset by the Roman conquest.

Inns and Hostelries. In most countries where the volume of trade is not great and where travel is not extensive, the traveler, whether he be engaged in trade or in some other pursuit, usually seeks the hospitality of the natives of the country he is passing through, and various mechanisms are developed to permit his safe passage. One reason why guests from the outer world are often welcome is that they bring news, and the local people have a chance to interact for an evening, or a day or two, with a new person.

When, however, the number of travelers becomes great, it is impossible to entertain all of them privately, and also the need for interaction of this kind has been reduced by the growth of institutional complexity. This is the point at which inns or hostelries develop. For the most part they seem to be limited to China, India, the Moslem countries, and medieval and modern Europe.

In some instances, as in early Ireland, the hostel was a concern of the government. There was one of these establishments situated at every strategic point along the principal roads of the kingdoms, and each was managed by a special officer called the Hospitaler. Today in India and Burma, the government has strings of "guest-houses" where the traveler can stay free of charge, and the Sultan of Mukalla in Arabia also has such an establishment.

As a rule, however, inns are not the concern of the government but are organized as separate economic institutions. In the Moslem tribes of Albania, a *han,* or inn, is found at the principal crossroads and fording places, and each han is about one day's walk from the next one in any given direction. The *hanji,* or host, usually runs it without any staff, since his duties are not extensive. The han itself is a building which usually contains three rooms: a large one which serves as a stable, a small cubicle which is the hanji's office and private storeroom, and a long, narrow room with a low roof and a fireplace at the end away from the door, which serves as a sleeping room for the guests. This sleeping room has a path running down the middle of the floor to the fireplace; on either side of the path is a

raised platform, a few inches high and about six feet wide. The guests are allotted space on these platforms, and lie with their heads to the walls and their feet to the path in the middle. The hanji does not sell food, but he lets the guests cook over his fire; he does, however, make the coffee, which he sells, as well as raki, a native brandy. When it is bedtime the hanji locks his guests in the room for the night, to prevent stealing.

In Western Europe, the innkeeper traditionally sells food as well as drink, and his establishment often serves as the general headquarters for the people of the village. Many inns became centers for the conduct of business, as did the coffeehouses. A number of banks had their origin in groups of men who met in these establishments; the best known of these is Lloyd's of London, which started about 1688 in a coffeehouse.

In Turkey and other Moslem countries of the Near East, where the male set is high in the family institution, the men habitually carry on most of their interaction in coffeehouses, while the women remain at home. This is true of Greeks as well, and this custom has been carried over to the New World, as the abundance of well-patronized coffeehouses in Greek, Turkish, Armenian, and Syrian sections of our major cities will testify.

As in all other economic institutions, the complexity of the internal organization of the system is a function of the frequency of interaction in the commercial set, which is in turn dependent upon the number of persons included as customers. Modern hotels and restaurants represent the most complex development of inns, just as the great department stores, like Macy's or Marshall Field's, represent the maximum elaboration of the shop. A modern hotel with two or three thousand rooms requires a large number of employees organized into departments: advertising, commercial, kitchen, room service, dining room staff, and so on. The bellboys are under the direction of a bell captain, the waiters under the head waiter who may have several assistant head waiters, and in the kitchen a fully developed processing set will be found with chefs specializing in particular kinds of cooking. The final development, as in the case of the department stores, is the development of chain hotels like the Statler, which are comparable in complexity to the chain store organizations previously mentioned. Here each unit represents a major sub-system, with different departments within the hotel making up smaller sub-systems, yet all the individuals are organized within the commercial set.

III. THE DEVELOPMENT OF SETS BASED ON TECHNOLOGY IN COMPLEX ECONOMIC INSTITUTIONS

We have just seen some of the ways in which complex economic institutions have arisen out of trading, i.e., out of the activities in the commercial set. As the frequency of interaction in this set increases, one also finds an increase in the interaction within the tangent systems which are concerned with manufacturing the goods to be traded. As these systems based on the manufacturing techniques become complex, they develop supervisory sets, but they also develop special sets directly concerned with the particular techniques in question, as we shall presently show by means of examples.

Collecting, Hunting. If we review the kinds of techniques covered in Chapters 6-10, we see, in the first place, that complex institutions do not ordinarily arise out of collecting, or at least out of food-collecting. In the case of hunting, the most complex ones known are the techniques of the Plains Indians in their buffalo hunts, previously described. In this case there is a three-class, administrative hierarchy, from leader to police to hunters, and a processing set from hunters to cutters. Other hunts which involve large numbers of people, that is, large surrounds, are more simply organized, with a leader, beaters, and sometimes special men to do the killing.

Sea-hunting provides the structure for a more complex type of organization, and this is particularly true of whaling, where it takes the combined efforts of a number of men to kill the animal and to handle its large carcass. Another factor which makes this technique complex is the inclusion of the technique of sea transport, with which we shall deal presently. A whaling company in the old days had central offices in New Bedford, with officers and staff like any business concern, clerks, bookkeepers, salesmen, and purchasing agents for ship supplies, as well as the crews of the various whaling ships themselves. Thus all the sets found in any kind of economic institution were found in whaling companies, as a direct result of the demand for whale oil, the abundance and habits of whales, and as a result of the techniques used in hunting them and processing their carcasses.

Fishing, Mining. Sea-fishing provides the framework for complex institutions. As in the case of whaling, this is due to the requirements of navigation as well as to those of fishing itself. Mining is another technique that develops in the same way; the abundance of minerals at certain concentrated places, the market for them in a technologically advanced world, the technical skill required for their extraction, and the need of advanced

transportation, all create a division of labor which again necessitates the development of complex administrative, staff-line and processing sets in the organizations concerned with this activity.

Agriculture. In agriculture, we have seen how people who do not need to work together often do so because they like to interact, while the technical advantage of this cooperation is actually small. The Bemba, as we have seen, limb and top the trees in the land which they are clearing in gangs of men competing with each other in speed and daring. The Dayaks of Borneo have work teams called "Hando"; usually a number of heads of families will get together to work on their fields, spending one day on the fields of each man, each taking his turn in a rotating system. This kind of organization is not an economic institution because there is no commercial set; each family keeps its own produce and for the most part consumes it.

Another kind of work-team arrangement, commonly found all over the world, is a work festival, like a corn-husking bee in this country, or a rye-planting bee in the Rif. At affairs of this kind the workers come voluntarily to help the host, who provides plenty of food and drink, and all work together, usually fast and furiously until it is done; then they sit down and consume the host's bounty with considerable gusto. This arrangement provides a chance for interaction on a relatively large scale, but does not provide the framework for an economic institution. In this regard it is comparable to sharing.

Economic institutions based on agricultural techniques usually arise only in relatively complex societies where the production of food is primarily for sale rather than for subsistence, and where the techniques require the interaction of a number of individuals over a relatively long period of time. A plantation, with a manager, overseers, workmen, one or more clerks, a processing plant of some kind, like a cotton gin or a sugar-cane press, and men engaged in carrying the product by road or water to a market, provides the necessary structure, and so does a Dakota wheatlands farm when operated on a large scale.

Animal Husbandry. In the field of animal husbandry, we begin to find economic institutions when one man owns a herd of cattle or a flock of sheep and hires someone else to pasture them for him, and when he sells some of the surplus animals, either "on the hoof" or in the form of meat, wool, or hides. This type of institution arises as soon as the commercial set is developed through a surplus, since it is easier for a flock-owner to hire someone else to herd his animals while he and his retainers are engaged in policing the camp and pasture and looking out for water. More complex institutions, such as a modern cattle ranch or dairy farm business, arise, as

we have seen, when techniques of transportation arrive at a high enough level of efficiency, and they become "businesses" with men in charge who occupy the Class A level in the hierarchy and who sit in offices and never brand a calf, shear a sheep, or milk a cow. In these businesses, there are staff-line and processing sets as well as the commercial and supervisory sets.

Transportation. The two kinds of technological activity which provide the greatest opportunity for the development of economic institutions are transportation and manufacturing. In the case of transportation, we have seen in Chapters 9 and 10, at some length, how the techniques themselves have brought about a division of labor and the need for accurate synchronization. On the Chinese camel caravan, there was a strong administrative (supervisory) set from the Head of the Caravan to the First Mounted Man to the camel-pullers, with the Head of the Pot, or chief-cook, forming the nucleus of a staff-line set. The caravan itself is merely a part of a larger organization, being a sub-system of the system which also includes owner, agent and customer.

In the case of a railroad company we find one of the most complicated types of economic institution known, with a long administrative hierarchy from the stockholders and the president of the company down to the ticket agents and passengers in the commercial set, with dozens of staff-line departments, including engineering and maintenance, public relations, etc., as well as process departments, signaling, and the actual crews of the trains. It is not only the train crew, with its conductor, engineer, firemen, brakemen, porters, etc., that needs to work in perfect synchronization, but also the "ground crew," to borrow an aviation term; the telegraphers, station agents, signal men, crossing tenders, etc. A railroad company is so complex an organization and is closely interrelated with so many tangent institutions that in most countries it is run by the state. Only in the United States, Great Britain and a few other countries, are private railroad lines allowed to remain as private institutions, because only in these countries is the administrative set in the political institution still low enough in frequency for this condition to continue.

Probably the clearest examples of how technical operations build up complex institutions are to be found in the management of ships. In a vessel of any size a number of people are required, as we have seen, to perform the necessary operations with accurate and rapid timing. The institution which results from the system of relations developed on board ship, with its high frequency of set events between officers and crew, is the most complex of all those developed in relatively simple societies, excepting only the military organization.

In the Trobriand Islands, for example, the sailing canoe which is used in the Kula expedition is commanded by its owner. There are two steersmen, each of whom has a steering oar, and a man who trims the sheet in response to shifts of wind or to changes in the course made by the helmsman. There are still two other men who are regular members of the crew, one who acts as lookout and also goes aloft to adjust the rigging, and a second who bails the water which is continually coming into the canoe. All these men act under the direction of the owner, who usually sits near the mast and issues his orders. These canoes have a single outrigger, and they have to be sailed with the outrigger on the windward side, so that if the wind falls, the sail has to be dropped, the mast unstayed, and the canoe turned 180° around. The stays are now taken forward to the new bow and the sail hoisted. As in any sailing vessel, continual adjustments have to be made in the trim of the sheets and in the general handling of the vessel.

In larger sailing vessels, such as the sailing dhows used by the Arabs in the Persian Gulf for long passages down the coast of Africa, as many as thirty men make up the crew, all of whom are needed in handling the gaff of a main lateen sail, which is often 125 or 130 feet long. The organization in this type of ship is relatively simple. There is a captain, a mate, a cook, and the crew. The men are not organized into watches as on European and American ships, but are allowed to sleep on the deck at night, ready to be awakened if any crisis arises. Only the helmsman and the lookout need to stay awake.

Once square-rigged vessels had been developed, the complexity of the operations needed increased, as did the danger to the vessel if all the tasks are not performed properly each time the ship is brought about. We have already devoted several pages to Dana's classic description of this process (see p. 219). In these vessels the administrative set, that is, the set of which the captain is a member of Class A, has a very high frequency. It is so high, in fact, that in many cases no member of the crew may originate action to the captain, even in pair events, and even the interaction from mates to captain is reduced to a minimum.

The development of such a clear-cut, hierarchical institution as that of a ship is the result of the high interaction rates imposed by the techniques of sailing a vessel. These activities require event after event in which the action of changing the course is followed by changes in the trim of the sheets and in the sails carried. Furthermore, these same activities were often repeated continuously over a very considerable length of time. In long sailing voyages, the routines of interaction in handling a vessel became almost completely habitual; nevertheless, even in daytime sailing, the dangers

of the wind and sea often produced crisis situations which made necessary a high frequency of origins of action by the ship's commander. For these reasons, the type of organization inevitably developed was that in which the supervisory set had a markedly higher frequency than any of the others.

Manufacturing. In manufacturing, as in agriculture and other pursuits, the simplest aggregations of individuals produced are informal work parties. We have given examples of these associated with the house-building techniques of both the Riffians and the Galla. In rural America, one still occasionally finds this system operating, as in a barn raising, and it is commonly employed for the simpler manufacturing techniques all over the world.

More complex techniques, or those that take a high grade of skill, require part or full-time specialists. In Tikopia, for example,[3] the technical process of making or repairing a canoe is carried out by several men who have had some experience at this work under the direction of a tufuna, or specialist. Firth describes in considerable detail how this expert superintends the activities of a number of helpers in repairing a canoe. In one case, the wash-strake had been eaten away by borers and a new piece had to replace it. Four men shaped the new timber with adzes, under the tufana's direction. When he thought it was nearly ready, he had them lift it up and hold it against the hull, and while they held it, he made measurements on a stick and marked the places on the new timber that had to be smoothed down so that it would fit. Five days of this kind of work went on before the whole job had been completed, and during this time the expert served as origin of action in a set of relations consisting of himself and his helpers.

This example, and that of the Taghzuthi leatherworkers, will serve to illustrate how manufacturing institutions begin with the development of specialists concerned with the management of techniques required by the customer which are not only difficult but also require precise timing in collaborative efforts. Another example is to be found in the organization of blacksmiths in Africa and Arabia.

The techniques of smelting and forging iron have already been described in Chapter 6, and it should be clear that the refractory character of the material, and the procedures of heating it to the proper temperature and maintaining the temperature while the iron is being worked, provide the basis for an iron-working institution. As a result the blacksmiths form groups of their own, and are only interrelated with other groups through the fact that villages, camps, or other local groups form their customers.

[3] Firth, Raymond, *We, the Tikopia,* London, 1936.

Where there is only enough demand in a camp or a village to support one worker, the blacksmith does all of his work alone, and confines himself to forging. This is the case in the Riffian village and the Arabian camp. Where the demand is great enough, however, the ironmaster usually trains a number of helpers, often his sons. One or more of them will work the bellows, and others may assist in handling the iron itself. Where smelting is concerned, the operation is more difficult than forging, and usually several men, under the direction of a master, are involved.

Once a specialized occupation of this kind develops in response to the requirements of trade, the maintenance of a clientele often requires that the specialists migrate from place to place, as there is ordinarily not enough demand for their services to keep them in any one village more than two or three days. This often happens in parts of Negro Africa. In such cases, the relations which the craftsmen have set up with their customers have a particularly low frequency.

The result of this situation is to make them a highly isolated system, and ordinarily to make their activities confined to the family system. There are many groups of these wandering technicians whose equilibrium is adjusted to a high frequency of interaction within the group and a low interaction outside in which the personnel is constantly changing. These groups include not only the wandering blacksmiths and musicians, but also such groups as the gypsies, the Solubbies, who are the coppersmiths in Arabia, and the circus people of Europe and this country. In many cases these occupational groups develop into occupational castes, a group of people united by kinship in a common occupation whose organization we shall discuss in Chapter 17.

In more complex societies, where trading becomes a full-time profession, we find the development of full-time industry. Among such groups as the Trobriand Islanders and their neighbors, none of the islands are self-sufficient, and there has developed a system of specialized production by which one group, such as the Amphletts, supplies a particular kind of utensil, namely, cooking pots. Archaeological evidence shows that this specialization is relatively recent on the coast of New Guinea. Formerly every village manufactured its own pottery, but with the development of the extended trading system, the necessities of exchange and the differences in the quality of the manufactured product, as well as the availability of raw materials, brought about this specialization. Nevertheless, the manufacture and sale of these pots are not a full-time occupation; it is incidental to the agricultural pursuits by which these islanders get a living.

In Taghzuth, as we have seen, this specialization has gone a step

further; due to the poverty of the environment and the difficulty of agricultural activities, the Taghzuthis increased their relations to the trading centers and gradually took over as a full-time occupation the manufacture, within the families and in shops, of objects for sale. This kind of organization is found not only in the more complex societies of North Africa, Europe, and the East, but is also common in the United States in industries in which the manufacturing process is carried on without power-driven machinery.

Even among the Taghzuthis, however, the increased dependence on trade relations requires a greater increase in output than ordinarily can be found within the family, where much of the time must be spent in caring for children, preparing meals, and in other activities more strictly associated with maintaining the family organization. Consequently, we find the development of shops in which a master supervises his workmen both in regulating output and in securing a certain uniformity in the quality of the product. Once this stage is reached in a society, we begin the era of mass production, which is associated with a marked increase in the complexity of the institution.

In Mesopotamia, the temples were the centers of the principal manufacturing enterprises and also controlled a large part of the agricultural production. Here large numbers of slaves were occupied in making pottery or cloth, much of which was offered for sale. Private individuals also owned such manufacturing establishments as were ordinarily included within a large merchant organization. Even in the time of Sargon, around 2500 B.C., great merchant houses were exporting their wares throughout the Near East, and importing into the flat Tigris-Euphrates Valley timber, gold and silver, and other materials which could not be produced within the valley. The rise of these merchant houses, which usually consisted of two or three partners, represents a form of economic institution which is characteristic of what we ordinarily call "urban civilizations." And in fact, once these trading organizations develop, we are provided with a convenient definition of a complex civilization as opposed to a simpler type of culture.

Mesopotamian business houses ordinarily consisted of the partners and their employees in the home city, and agents in the principal cities or areas where they bought and sold. Such trading houses with a strict hierarchical organization have also been found among the Phoenicians and Egyptians, the Arabs and the Chinese, in medieval Europe and in modern civilizations.

The Mesopotamian and other such organizations had a complex set of relations involving the interactions of many people, and the equilibrium

which resulted was continually subject to disturbance, thus making a strong administrative set necessary. Once a group of customers had been found for the products of the house, the task of supplying their needs produced a regular series of events within the system which had to be kept going at the accustomed frequency. If the customers were used to buying cloth or food at regular intervals, any interruption in the supply would upset the system and cause the interaction in the relations to decrease markedly. Since the customers depended on the constant supply of goods for the maintenance of equilibrium in their own system, they would have to turn to another merchant house if the first failed them.

For example, if the organization manufactured and sold cloth to a number of tailors, inability to deliver, due to a breakdown in the manufacturing processes, would mean a disturbance in the tailor's relations to his customers. As we have seen in the first section, any disturbance in the habitual relations of an individual requires a restoration of his equilibrium, and this can be achieved by entering into new relations which have the same frequency of interaction as the old. This is just as true of economic as of other types of institutions. Complexity of structure due to the manufacturing process can only be maintained in an institution as long as its trading relations are stabilized.

Power-Driven Machinery and the Complexity of Economic Institutions. In all kinds of technological activities the introduction of power-driven machinery usually brings about an increase in the size and complexity of institutions, since, as we have seen in earlier chapters, it permits a greater surplus per man-hour of work, and it institutes a more complex division of labor. This is true of such activities as whaling, sea-fishing, mining, and lumbering, as well as of agriculture and animal husbandry. It is particularly applicable to transport and manufacturing, and it is through the interrelations of transport and manufacturing techniques that this is made possible with the other techniques. We have already considered the organization of a railroad company. A steamship company is just as complex an organization, with its agents in every port, its relations to the companies whose goods it carries and to the insurance companies, the governments in control of the ports and their harbor administrations, as well as to the complex hierarchy made up of the crew of each of its vessels.

Let us study for a moment its effect upon manufacturing. In a simple society, such as a rural New England town of over one hundred years ago, economic institutions, with few exceptions, consisted of a specialist and his clientele, and in rare cases the specialist had one or two assistants. A shoemaker made all of the shoes for his customers, and the total number of

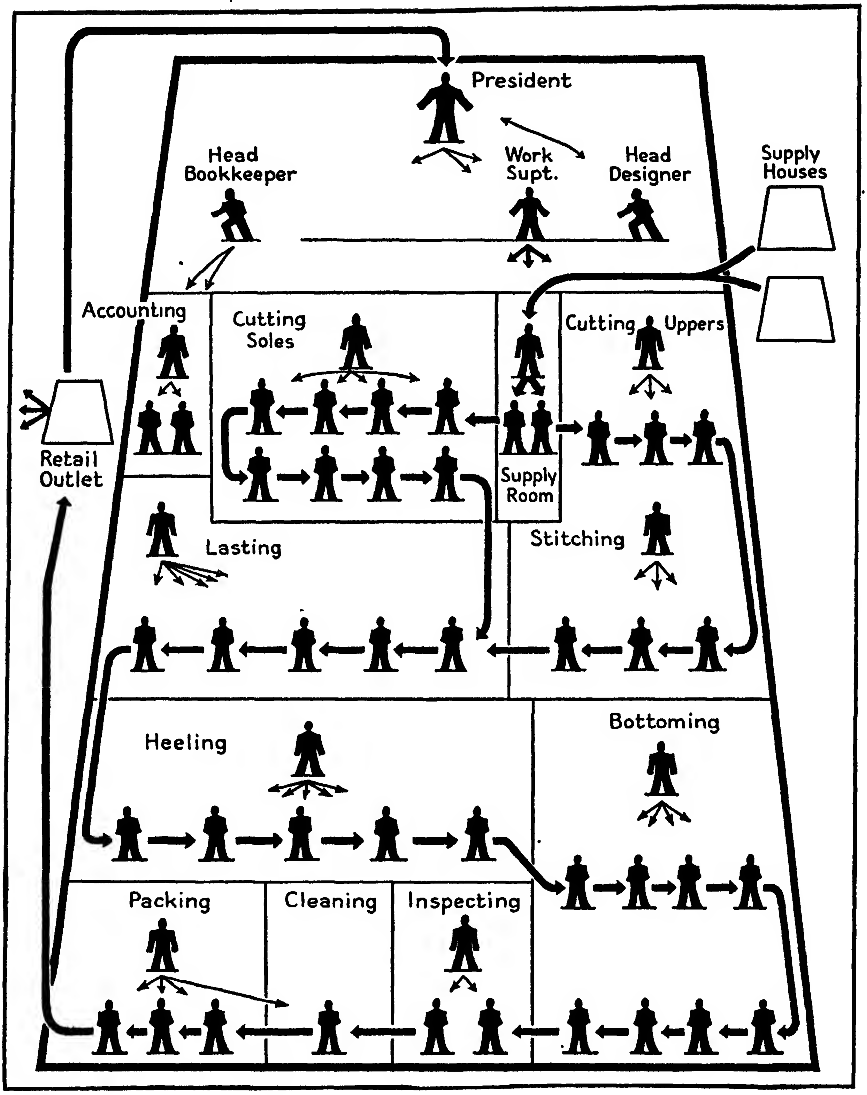


FIG. 10. A SHOE FACTORY

For key to symbols, see Figure 3b, page 284.

pairs that he could make in a year was very small. At about this time, power machinery was introduced into New England, where the abundance of swift streams produced an ideal situation for manufacturing. The use of power began, as we saw in Chapter 6, in Rome with milling machinery, and it was generally confined to this limited field until the late eighteenth century, when it was applied, mostly through the agency of steam, to the textile industry. This was the beginning of the industrial revolution. These new power techniques were carried to New England, and there they were transferred to many other industries besides textiles, and notably to the shoe manufacturing business. With the use of the new machinery, shoemakers could perform many of their habitual operations with a much greater speed than before, and with more uniform results. The use of this machinery required that the individual running it become a specialist in its operation.

It soon became necessary, in order to increase the volume of production, to develop a series of operations, each of which required the specialized techniques of a skilled operator. Whereas in the old days, a shoemaker performed all the operations required in making a shoe, it was found that more shoes could be made if each worker performed a single operation. Thus the main stages of making a shoe were allotted to single individuals: a cutter cut out the leather in the required shape; the stitcher sewed the pieces together; the laster put on the sole; and the heeler attached the heel. The final treatment of a shoe, including its polishing, was done by finishers; and finally a special individual packed each pair of shoes in a box.

Each process involved the passing of the partially completed shoe to the next operator and thus the technique of operation imposed a series of interactions from cutter to packer. In a modern shoe factory these basic divisions represent the order of the operations, but within each department there is a further division of labor, so that a modern woman's shoe is the result of at least sixty different operations ordinarily, and in some cases one hundred and twenty.

With the development of such specialization in techniques there has been a consequent elaboration of the supervisory set. The workers in each department are originated to by assistant foremen, who in turn respond to the origins of the foreman. In the ordinary shoe factory only two more classes of originators are to be found, the president being in the first class and the plant superintendent in the second. Here then are five classes in the supervisory set: the president, plant superintendent, foreman, assistant foremen, and the workers.

Besides this supervisory set, the technical process itself provides a framework for another set of relations which we call the processing set. The neces-

sary dependence of each process upon the preceding, and, in fact, of all subsequent ones upon any given one, means that a change in the rate of activity of one operator may produce responses throughout the factory. Each department, however, consisting of foreman, assistant foremen and workers, makes up a sub-system, for the interactions between the members of the department, both in the supervisory and processing sets, are much more frequent than those between the members of different departments. In most organizations, foremen rarely originate action to workers not in their department. At least one other set often develops in a factory; the staff set, in which the origins of action proceed backward against the flow of work. This develops from the inspection of materials and the refusal of a department to process faulty work coming to them from workers on an earlier process.

Considerable changes take place in the equilibrium of such a system, due to fluctuations in the speed of work as well as in the tangent relations of the organization to other organizations. Where a shoe factory, or any other organization, is continually able to sell its product, the work relations become stabilized and the system may remain in a state of equilibrium for a long period of time. Where the system of sales is not in a state of equilibrium, there is a marked fluctuation in the interactions in the factory. For some periods it may, in fact, be shut down, in others working only part-time and with a small proportion of its total force, and again at other times working at full speed. Such continual changes in the amount of business have profound effects on the equilibrium of the organization, and major disturbances naturally result.

The problem of the industrial manager is not only to try to stabilize his production and reduce the changes in interaction rates to a minimum, but also to see that the introduction of changes in technical processes take place with a minimum of disturbance to the relations of the individuals in the system. If men have been accustomed to working in habitual association with other individuals in terms of a process, a change in the method of production which changes their relations disturbs their equilibrium. When such changes take place, care must be taken to adjust the individuals in their new work relations in such a way that they most closely approximate their previous interaction rates. Similarly in making changes in a supervisory set, if the workers have been accustomed to a foreman with a low origin rate, serious disturbances in equilibrium take place when a supervisor with a high origin rate appears. Some device has to be introduced to provide the workers with means of compensating for the change in interaction rates and in restoring their equilibrium.

This ability to synchronize must be carried to a fine point of accuracy in modern industrial plants, where the workers must turn out a large daily output by means of a number of interdependent processes. Roethlisberger and Dickson[4] give an excellent illustration of this principle in their description of the bank-wire room at the Western Electric Company plant.

In this department, the essential process consists of three principal operations: (1) A wireman fastens wires to terminals on a number of banks, to connect the banks together. (A "bank" in this case is a frame on which the terminals are serially arranged.) (2) After this operation has been completed, a solderman solders the wires to the terminals. (3) An inspector then tests the terminals to see whether all of the connections have been properly made.

In this room, a continual sequence of events habitually takes place. Wiremen originate to soldermen, and soldermen to inspector; also wiremen to inspector. The completion of these three operations is necessary before the job can be considered finished. Now at one time, a new inspector who had had little experience at this type of work was brought into this department. The wiremen and soldermen, working in a team, had been accustomed to a high rate of production, and the new inspector, who was inept at this work and very slow, kept holding up the wiremen and soldermen. At first they tried to help him when he got into difficulties, but as he was unable to increase his rate to fit theirs, they soon grew tired of it, and began to originate to him more and more, in order to compensate for the disturbance which he was causing. At times they would work at a very high frequency and would keep calling him over when he was still trying to test another set of terminals. Sometimes they would wire only parts of their terminals, in order to make him inspect more frequently than ordinarily, and again, at other times, they would slow down their work rates. Finally their frequency of origins of action became so high that the inspector went to his superiors and complained. This disturbance of his equilibrium was followed by disturbances throughout the department which finally ended when the inspector was transferred.

In this example, the failure of the inspector to adjust his interaction rate to those of the wiremen and soldermen disturbed their relations and upset the equilibrium of the group, and it was only restored when the disturbing individual was removed. Such situations are equally common in the technical processes of the simpler societies, and this is true not merely in manufacturing processes, but also in hunting and fishing, in paddling a

[4] Roethlisberger, F. J., and Dickson, W. J., *Management and the Worker*, Cambridge, Mass., 1939, pp. 375-550.

canoe, or, in fact, in any sort of technical activity where two or more persons are concerned.

As industrial corporations develop more and more tangent relations, a great change takes place within the organization, modifying the system in response to increases in interaction in the tangent relations. Thus a large factory may begin by being dependent upon a few outlets for its goods, and the president of the company, or one of its officers, may be able to do all the interacting necessary. In many cases an organization may sell through an agent, who devotes his time to selling the goods of the firm. If the company manufactures products which are sold in large quantities to many small institutions, a single individual is obviously unable to interact with high enough frequency with all their customers, and as a result a selling hierarchy has to be developed to maintain these interactions at the proper frequency. This often requires weekly, and in some cases daily, visits to customers. If this interaction was not maintained, other competitors would be able to build up their frequency and take away the business, for as we have seen in our discussion of the physiological mechanisms involved in human relations, the conditioning of two individuals to interact has to be reinforced periodically, or else the relationship will break up.

Banks. One further elaboration of economic institutions has to be discussed, and that is the development of financial institutions which stabilize the relations of producers and consumers. We have already seen how considerable disturbances in the interactions of individuals may be caused by the failure of economic institutions to become adjusted to one another. Oftentimes a number of institutions are tangent to one another before a truly stable adjustment can take place. Each economic transaction between them involves a balance in the origins of action of the interacting individuals. A gives an object to B, who in turn gives back another object. This reciprocal character of interaction distinguishes the relationships in these institutions.

It often happens, particularly in the case where a number of institutions are involved, that the producer of raw material cannot receive his return payment until the manufacturer has processed the material and sent it to a retailer, who then sells it to the customer. The transaction is not complete until each interaction has taken place. In order to bring this about, a series of regulations of the frequency of the interaction has been developed in order to maintain an effective balance. This includes specifying the duration of time that has to elapse before the second event of repayment shall take place, and also the series of events which must take place at stated intervals before the transaction is considered complete. In order to stabilize these

relations, institutions have been developed in which the individual sets up tangent relations with each of the institutions involved in the transaction.

In Kaisenkung village in China, for example, many of the heads of households periodically run out of money. This may happen when taxes or landlords' rents are due, or just before the harvest. When this happens the farmer goes to one of a number of money lenders, who gives him the cash needed at a high rate of interest. The single money lender and his clients form the nucleus of a banking institution. In parts of China where the economic enterprises are more complex, true banks have developed in order to finance the business operations of economic institutions, in much the same way as our own banks.

In the United States, banks are an important element in the equilibrium of economic institutions. They have developed complicated sets of relations within the institution and an elaborate segmentation in the development of sub-systems. Some departments are specialized to handle real estate, including the building of houses for sale, which involves a large number of relations between different specialists lasting a considerable period of time. Other departments are concerned with loans to industry, to retail organizations, and with the supervision of family property. The frequency of events which takes place in the relations of a bank to its customers is in our present system one of the most useful indicators of the state of equilibrium of our society.

SUMMARY

Economic institutions are concerned with the exchange of products between individuals and groups, as well as with their production and manufacture. They are an outgrowth of the division of labor and trade, when these go beyond the family system. Every economic institution includes a *commercial,* or seller-to-customer, set, since trade is the basis of its existence. In this set of relations the seller interacts at a low frequency with a large number of customers. Since this is an essentially haphazard relationship, executives of business concerns like to make their clientele as regular as possible, in order to maintain equilibrium in their own systems. In the simpler economic institutions the characteristic type of personality is that of the salesman, who has a high origin rate and a capacity for brief, intermittent events at a high rate of interaction. Only when complex economic institutions develop does a capacity for leadership become essential.

Trading, among the simplest peoples, is intermittent and consists more of mutual gifts than of negotiated transactions. As the volume of trade and the complexity of societies increase, regular markets are established to meet

at fixed places on fixed days, and as further increases take place these will meet every day, and towns may grow up-at-the market centers.

Some economic institutions specialize in production or manufacturing, and the commercial set consists of the manufacturer and his agent. In such systems little time is spent in the operation of this set, and such institutions may be considered tangent to trading institutions. The trading institution proper specializes in buying and selling, and may produce none of its own goods. The development of special producing and special mechandising institutions as separate systems comes with the increasing complexity of societies.

In societies of moderate complexity, and in the most complex ones as well, we find peddlers and traders going from door to door with merchandise, either as private merchandisers or as agents of trading institutions. There are a number of special trading peoples in the world among whom whole families, villages, or districts specialize in this trading and send out their members to distant parts of the world. Among such peoples the entire adjustment of institutions is built around this practice. Such people usually come from environments where the landscape cannot support a large population at their level of technology.

In complex economic institutions some of the sets are based directly on technology, due to the complexity and special requirements of the techniques in question. These include primarily the staff-line and processing sets. The most complex systems of this kind are built up around the techniques of manufacturing and transportation, and the most complex of all are probably railroad and steamship companies. Since these institutions are closely related to many tangent institutions, they are, in most countries, run by the state. It is only in a state where the administrative set of the political institution has a low frequency that these companies remain in private hands.

The factor that makes these economic institutions really complex is the use of power-driven machinery. The great speed of operation and segmentation of activity, and the need for accurate timing, make it necessary to work out fine adjustments between individuals and departments in both industrial plants and transport companies in order to preserve equilibrium.

CHAPTER 16

Religious Institutions

I. INTERNAL CRISES AND THE DEVELOPMENT OF LEADERS

In the last four chapters we have been concerned with the development of institutions resulting from routine activities. In the family, we saw that the constituent sets of relations developed as a result of the limitations on interaction imposed by the process of child-bearing and child-rearing. The presence of several children who must be cared for automatically results in set events, and differences in the division of labor based on sex and age were the prime factors in elaborating the structure of the family institution. In the political and economic institutions, the development of sets was the result of the relation of one group to another; in the political case, it followed the occurence of crises in the adjustment of groups to one another; in the economic case, it depended upon the exchange of objects by which the technological adaptations of a people could be maintained.

We have now to consider a type of institution which results from the occurrence of disturbances in the equilibrium of a group which are not the result of origins of action of others outside the group. What happens here is that through birth or sickness or death, or as a result of changes in the environment producing changes in the technology and hence in the interaction of individuals, a disturbance, or crisis, occurs in the equilibrium of the group. The changes in the interaction rates are compensated for by some individual who originates action in set events to the disturbed individuals and restores their equilibrium. For the period of the crisis he becomes a leader. If a similar crisis affects another group of individuals he may originate to them. If his origins of action have the proper effect, he may develop a following of people conditioned to respond to him in crises of this sort. Such a person is called a priest or a *shaman* (a word derived from a Siberian language).

The important characteristic of a set of relations involving a priest and his followers is that it does not result from disturbances in the outside rela-

tions of the group. The disturbances occur consequent upon events within the group which necessitate a restoration of equilibrium. There is, therefore, no external relations set or anything comparable to it. The priest-leader does not lead the people against the members of another group; he leads them in situations which produce profound emotional disturbances, the causes of which are usually not understood by the persons involved. There are two types of crises in which the priest by his leadership restores equilibrium. The first of these results from a change caused by a single individual; the second involves a change affecting all the members of a group.

When a person is born, comes to puberty, gets married, becomes ill, suffers bodily injury, dies or is initiated into a new institution, his relations to other members of his group are necessarily changed. The process of change in the interaction rates, upsetting the equilibria of the individuals concerned, is countered by a series of techniques requiring the interactions of the disturbed individuals in specific and habitual ways. These techniques are called *rituals,* and if the rituals are associated with the crises derived from the actions of a single individual, they are called *Rites of Passage,* a term applied by Van Gennep,[1] the first author to recognize their significance and to work out in a preliminary way the stages by which the adjustment of the members of the group take place. In Part IV, where we shall deal with the problem of ritual and the symbols associated with it, we shall discuss these rites in more detail. For our present purposes, however, we shall deal with them only to show how religious institutions develop as a result of their use.

Crises of the second type, which involve a disturbance of all the members of a group, are most commonly the result of changes in the environment, such as the alternation of the seasons and even the succession of day and night. They are crises, of course, because with these changes people have to alter their activities, and each change of activity involves a readjustment of the interaction rates.

In agricultural communities, important crises, that is, crises which involve relatively great changes of interaction rates, come in the spring at planting time, and in the fall at harvest. Among hunters and food-gatherers they come when the caribou migrate, the salmon run, or the pinyon nuts are ripe. The ritual techniques used in these crises enable individuals affected by the changes to build up the new interaction rates needed to restore their equilibrium. Since the interaction rates of the members of a group increase in these rites, we shall call them *Rites of Intensification.* They differ from

[1] Van Gennep, A. L., *Les Rites de Passage,* Paris, 1909.

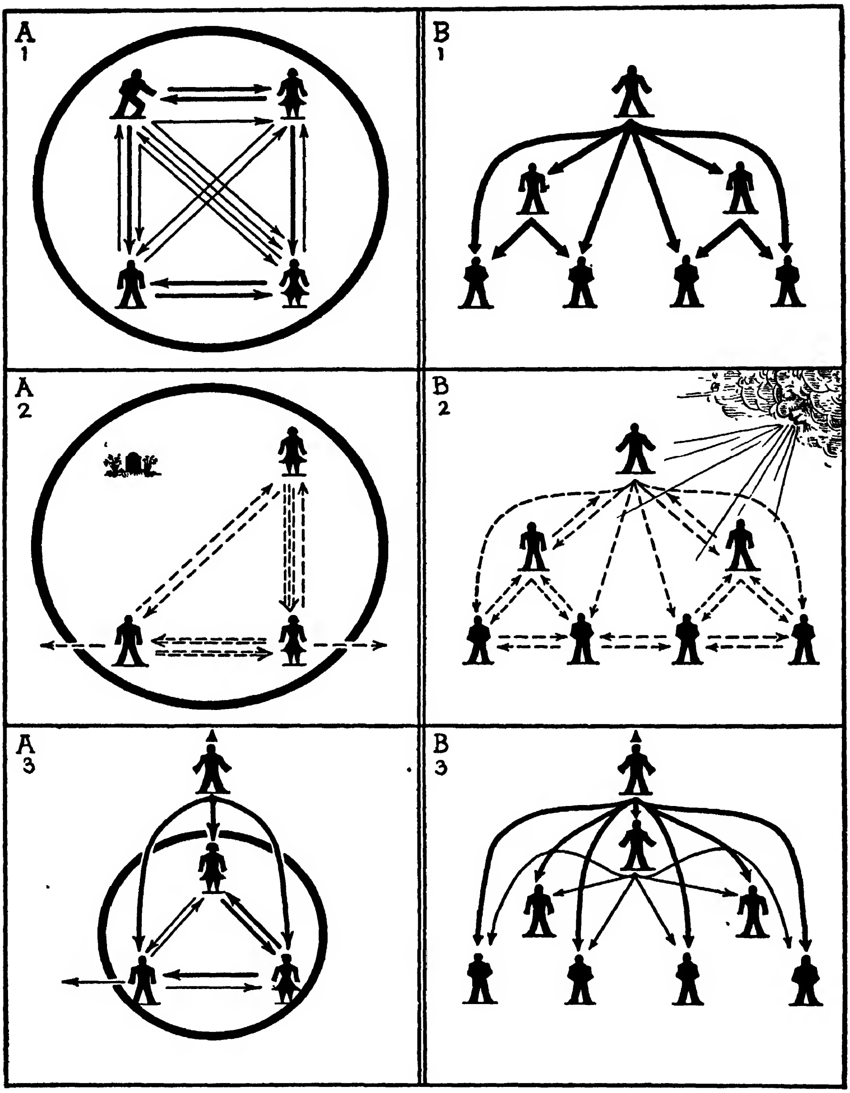


FIG. 11. THE RESTORATION OF EQUILIBRIUM THROUGH RITUAL

(A) A RITE OF PASSAGE. (1) A family in equilibrium. (2) Disequilibrium caused by death of father and reduction of habitual interaction. (3) Restoration of equilibrium: shaman interacts with family in ritual techniques, restoring amount of interaction and stabilizing equilibrium long enough to permit readjustment at a new level.

(B) A RITE OF INTENSIFICATION. (1) A system in equilibrium. (2) A crisis disturbs the order of action, reduces the interaction, and upsets the equilibrium. (3) The shaman originates to members of the system, directing them in ritual techniques and thus restoring the disturbed interaction rates.

For key to symbols, see Figure 3b, page 284.

the Rites of Passage in that they involve a change in all the relations of the group in roughly the same degree.

In the simplest societies, Rites of Passage and Rites of Intensification may be performed within the family system, and in that case the leader is the father or head of the clan. No religious institution proper, therefore, develops, because no new sets arise. Where political institutions have been built up, the political leaders may concern themselves with ritual techniques, and this is also true for economic institutions; in Tikopia, the specialist at canoe building who directs the actions of his helpers begins each stage in the construction of a canoe by leading a ceremony. In other words, just as we saw in the case of other institutions, the performance of certain techniques, or even the appearance of a set of relations linking the members of an institution to people outside the group does not necessarily result in a new institution. Only when the membership in the sets within the group is different and a leader and his followers arise, forming a set not coterminous with already existing sets can we speak properly of a religious institution. The characteristic of a religious institution is, therefore, the appearance of an independent set made up of the priest and his followers, and we shall call this the *Religious* set.

When a crisis occurs, the members of the group are no longer in a state of equilibrium. For reasons which we discussed in Part I, they are emotionally disturbed. The techniques which the priest employs in such a situation bring about interaction between them in orderly response to his origins. He leads them in prayer or in a responsive reading, he sprinkles them with water or blood, or brings about a synchronized response to his actions in any one of almost numberless ways (the reasons for which we shall discuss in Part IV). Even where the crisis may not directly affect a person, as in the case of injury to the crops or illness among the cattle, the same principle holds.

Among the Banyankole of East Africa, if sickness broke out among the cattle, the owner called in a cow doctor (priest). The doctor would first ask for a bull or an old cow, and would then drive it all night around the kraal. At daybreak, he brought the animal to the entrance of the kraal, and killed it, cutting its throat and catching the blood in a vessel. Then, taking a bunch of herbs, he sprinkled all of the people who lived in the kraal with the blood. Then he sprinkled the cattle. Once this was completed, he ordered the people out of the kraal, and then drove the cattle out after them. By performing these ritual techniques the priest thus originates action to his clients in set events and helps restore their equilibrium which the cattle epidemic had disturbed.

After performing rites under various conditions, the priest, or shaman, gradually builds up a clientele, or following. This is particularly common after cases of illness, and people who have been cured may continue afterwards the high frequency of their interaction established during the ritual treatment. Just as the immediate followers of the political or economic leader may originate to others as members of Class B in a set, so the disciples may take part in the ritual activities under the priest's direction. They may chant, or play musical instruments, prepare the ritual paraphernalia, or in various other ways themselves originate, with a lower frequency, to the disturbed individuals. Once the religious set begins to differentiate in this way, complex religious institutions develop. It is from such beginnings that many of the world's greatest religious organizations, such as the Christian churches, Islam, and Buddhism have arisen.

Such systems appear in one place or another almost continuously. An example of this is the Taro cult which arose rapidly in response to disturbances of equilibrium in the Orokaiva country of Papua Territory, New Guinea, during the 1920's. The disturbance which evoked it was the arrival of government officials and missionaries in this region, and their attempt to break up the old way of life, and in particular to prevent the people from holding some of their ceremonies.

Several religious movements swept over New Guinea as a result. In the Taro cult, which was one of them, the prophet, or leader, was a native named Buninia, who was said to have suffered from epileptic seizures from childhood. This prophet had a vision in which the spirit of the Taro visited him, possessed him, and left instructions for a whole new complex of rites to be used in connection with Taro growth magic. The prophet made his first converts one day as he sat chewing betel nut. He was seized with violent paroxysms and cried out, "Taro, Taro!" People flocked to hear him, and began to be affected by his movements and began to shake in time with them. After a while he began to harangue them and told them how rites and dances should be conducted to make the Taro grow. The more energetic converts at first went on tours to proselyte distant villages. They began by spreading propaganda about the advantages of the cult and the better Taro that was grown by using the rites. Then a band of the prophets would exhibit the dances and ritual, during which they would be seized with paroxysms. Some of the onlookers would also succumb, and when they were seized, they would be acclaimed as prophets and taken in as members of the cult. Quite often some individual would invent a variation in the technique of the ritual and his converts would practice this procedure. Occasionally this process, under the influence of some high originator, built up

a sect, and members of different sects began trooping around the country competing with one another in the race for converts. Some of these competitions were almost like political meetings, with members of rival sects trying to outdo each other in dramatic performances and thus get the spectators to respond to their origins.[2]

In the development of this cult, the set of relations was not built up with a high frequency between the original founder of the Taro cult and his immediate followers who became leaders of small groups. He apparently was unable to develop the kind of religious institution built up by the Booths in the Salvation Army, by Mary Baker Eddy in the Christian Science Church, and in many other cases. Nevertheless, the rudiments of such a set do exist because leaders in the cult in one tribe are recognized by votaries of the cult in another tribe, and thus the set is made up of a group of leaders originating with a high frequency to their followers, who in turn respond only intermittently to the original founder. With this development, the Taro leaders not only lead their followers in the rituals and dances of the cult, but also have taken over such other activities as making rain, curing illness, etc. Their followers are continually giving them food and gifts, and this extends even to the times when they are traveling in alien territory. With the rise of this cult, there has been a marked increase in the frequency of feasts and dance ceremonials, and the cult seems to represent a compensatory increase in interaction consequent upon the forced reduction in the frequency of ceremonial activities through the efforts of missionaries and government officials.

II. QUANTITATIVE CHARACTERISTICS OF THE RELIGIOUS SET

The religious leader, as in the case of Buninia, is one who is able to control the interaction rates of groups of emotionally disturbed individuals. In many cases, in the simpler societies, the development of a set may involve violent manifestations of action, such as the epileptic fits to which Buninia himself was subject, but in any case, what is necessary is that the priest have the capacity for getting and maintaining synchronous interaction with the persons making up the disturbed group. If the disturbance is a minor one, that is, if the frequencies of the interaction have not been too greatly changed, the events involved may be relatively short, and the intensity of the interaction not too high. If the disturbance is a severe one, involving a number of persons, the interaction of priest and followers is proportionately long.

[2] Williams, F. E., *Orokaiva Magic*, Oxford, 1928.

Not only are the events long, but the character of the interaction is such as will have the greatest effect on the autonomic nervous system. This involves the predominant use of rhythms in the interactions, rhythms which are much more regular than those ordinarily found in conversation. They may be controlled by the beat of a drum or the sound of musical instruments; the verbal formulas included in the ritual techniques may be spoken in meter; or the actions in the techniques may involve orderly postural changes. In any case, action of priest is followed by action of his clientele in orderly succession until the rhythms have been reinforced by the activation of the autonomic nervous systems of the participants.

Anyone who has ever attended a revival meeting of the more evangelical sort in this country has seen how the rhythm of the interaction rouses the audience to such a pitch that they respond in a frenzied chorus to the actions of the preacher. Even in ordinary religious meetings, a similar talent for control of the interaction, a precise adjustment to the interaction rates of the group, is necessary for the successful leader. Those qualities of accurate timing of which Mark Twain spoke in the quotation in Part I are fundamental if the priest is to restore equilibrium.

In order to obtain the rhythmic interaction which will achieve the restoration of equilibrium (temporarily at least) in his congregation, the priest must possess a native aptitude for this type of interaction. In many societies, as we mentioned in Part I, individuals who display neurotic or psychotic tendencies become priests. Persons who are unable to adjust to others may seem like the last persons competent to operate in a situation of this sort, but it is just this lack of adjustment which produces its effects. Psychotic or neurotic individuals have much more definite rhythms than normal individuals; they are much less variable and they are, therefore, capable of the long, concentrated, rhythmic interactions in events which would be almost impossible for a normal individual to maintain except under the influence of drugs. Very often the effect of the rhythms is to produce a state of hypomanic excitement in which the individual is operating almost completely under the control of the lower centers in the brain. In this country, individuals having this property are usually confined to institutions, but among simpler groups, when persons of this kind occur in any numbers, they may be immediately started on the road to specialization as priests or shamans.

We have an unusually large amount of information about the way the shaman is chosen among the Chukchi. Usually the members of an extended family themselves select him from their group, and it is clear that in all cases the heir of the family, who is to inherit the reindeer herd, never be-

comes a shaman. Ordinarily this heir is the oldest son, and if he is incompetent in handling the herd he will be disinherited and an abler son substituted. In the Chukchi family system, the possibilities of obtaining a living are very limited for any boy other than the principal heir. He can become a herdsman for another reindeer owner, and by careful tending of the reindeer which he receives as payment for his services, become an owner himself. He can, in some cases, marry his employer's daughter and inherit his father-in-law's herd. He can become a trader, exchanging goods with the Russians, which is an activity of the Maritime Chukchi. There is no other alternative except to become a wandering adventurer or a shaman.

The younger son, therefore, often occupies a position of considerable instability, and the effect of the high origins of action directed toward him by his father and elder brother may result in his developing one of two types of personalities: (1) the *érmečin,* or wandering adventurer, the "violent man," or "bully" described by Bogoras, a man who originates action to everyone, acting as the fighting man of his family and thus making a compensatory adjustment; and (2) the man with a shy, introverted personality, whose origin rate has been inhibited and who is often (from the evidence) a mild schizophrenic. Such an individual possesses a capacity for behavior in a catatonic state which will obtain responses from the members of the group, and the violence of his activity often compels individuals to respond automatically if they themselves are mildly disturbed. In the description of the Taro cult at Orokaiva we saw an example of how this came about. Individuals of this second type are selected, among the Chukchi and elsewhere, as shamans or priests. Thus in Dahomey, while Herskovits was watching candidates for the priesthood go through one of their ritual dances, an onlooker told him that a female infant who showed particular abandon would make a very fine priestess, since it was believed that people in such a state of frenzied action had been possessed by the gods.[3] In many other groups, however, the priest may be selected for other qualities, particularly in the complex institutions where there is a wide division of labor. He may have the capacities of a political leader, or he may be a good administrator. But in any case, whether or not the priest possesses neurotic or psychotic tendencies, he must be able to master the techniques by which equilibrium can be restored to his followers after a crisis and thus maintain his following in a stable system.

The Priest's Training. We are all aware of the length of time and the amount of study it takes to train a young man to become a Protestant minister or a Catholic priest. The religious leader must learn how to per-

[3] Herskovits. M. J.. *Dahomey.* New York, 1938, Vol. II, pp. 122-123.

form the ritual techniques by which he is to evoke responses from his clients. In our own civilization, aside from ritual itself, a large part of these techniques consists of sermons and lectures, and in order to give these effectively the priest must study not only religious writings but also the techniques of other institutions to which his clients also belong, so that he may give his discourse the content which will evoke the necessary response.

No matter how simple the general cultural level of the people among whom they live, all religious leaders have to go through a considerable amount of training. Among the Andamanese and Vedda, for example, the youth chosen by the shaman as his successor simply follows the shaman about, watches him, and is given, from time to time, special revelations and instructions, so that when the time comes for him to take over his duties he is ready. In the island of Car Nicobar, where the prospective shaman is usually a youth chosen because he has passed through a severe illness, the other shamans take him away from his home as soon as he has recovered. They conduct him to a secret meeting place in the jungle in the center of the island, where laymen never go, and here they give him a course of instruction which lasts for several months. Then they carry him about from village to village in a specially constructed litter, until his period of novitiate is ended. In this way he is not only instructed but also placed in a position in which he can attract the attention of the members of the client class in the system, and thus learn to originate to them, and to make them respond to him.

Very often the instruction is accompanied by ordeals, which include a period of seclusion. The Creek Indians, who had fairly complex religious institutions, used to make their candidates sit naked, without food, on the bank of a river for three consecutive days. During this time the older shamans went over the ritual techniques with them continuously. When the three days were up the candidates received the lowest degree of shamanhood. Higher degrees required six and nine day periods of privation respectively. In such a system, the candidate receives the bulk of his instruction over a longer period of time and under less rigorous conditions. This period of ordeal is merely the culmination, like our examination period. Needless to say, the state of physiological tension in which he is placed makes him respond with greater intensity than he would under ordinary conditions.

In Dahomey, there are many religious cults, each of which has its own techniques of instructing and initiating its novices. Herskovits witnessed a number of these ceremonies, and describes in particular a practice session

preceding the initiation of a group of five novices in the Mawulisa cult.[4] The total period of training lasts seven months, during which the novices live in the cult-house, completely isolated from their families, and cut off from all interaction except that which takes place within the religious hierarchy of which they are the terminating class.

At this particular practice session, an elderly priestess led the procession of devotees. She was followed by a younger priestess of the permanent staff of the temple, and then by some of the older members of the last group of novices to complete their training. Finally, the five new candidates appeared. The procession circled around the principal shrines of the enclosure, stopping at each, and dancing to the rhythm of drums. For several hours the novices practiced dancing in this way under the direction of the priestesses, and this dancing and the procession involve ordered interaction in set events.

During their seven months' period of isolation, the novices not only practice ritual dancing, as described above, but they are rigidly trained in other ways of behavior special to their institution. During this period they have the cult markings scarified on their bodies, learn the special language of the cult, and rehearse songs. Furthermore, they are taught at great length the things that they can and cannot do as members of the cult. During this period, therefore, they are being originated to continuously by different individuals in Classes A and B of the hierarchy, which is one of considerable complexity. They are conditioned not merely to respond in set events almost automatically, but also to develop the special interaction rate characteristic of a priest by suppressing their own origins except during times of ceremonial excitement.

This is brought about by the inflexible pattern of ritual, aided by the use of the arts, including drumming, singing, and dancing, which, as we shall see in Chapter 25, precisely control the rhythm of interaction. These art rhythms impose on the individuals who take part in the ceremonies a series of actions and inactions of fixed durations, and this permits a synchronization of their rhythms of interaction. These rhythms, in consequence, have a profound effect upon the activity of the autonomic nervous system. It can be seen, therefore, how important a part is played by these activities in building up systems of relations in religious institutions.

[4] Herskovits, J. H., *Dahomey,* New York, 1938, Vol. II, pp. 111-127.

III. THE DEVELOPMENT OF COMPLEXITY IN RELIGIOUS INSTITUTIONS

The Differentiation of Priests. In the general progression of human societies from simple to complex, a division of labor takes place in all fields of activity. This is just as true of the priest's profession as it is in the fields of manufacturing, transportation, or political leadership. Among people living on the simplest technological levels, as for example the Andamanese, Australians, and Ona, the only man who is even a part-time specialist is the shaman, and even he has to spend most of his time, like other people, in the pursuit of food. Within the shaman's profession, however, even at this level, lie the beginnings of the techniques of the physician, the astronomer, the priest and the detective.

The shaman restores or maintains the equilibrium of his clients by many techniques. Overtly he cures people by rubbing, sucking, and the extraction of magical substances. He communicates with the spirit world, often while in a state of trance. He predicts and tries to bring about changes in the weather. He smells out criminals, i.e., persons who have disturbed the equilibrium of the group, by various methods of divination. He conducts most of the ceremonies in his group, which involve serious disturbances and which concern a large number of persons. His multiple duties, therefore, involve an extensive knowledge of techniques, but not more than one man can learn. As the number of techniques increases consequent upon the rise of new varieties of disturbances which upset the equilibrium of the group, priests begin to specialize among themselves.

The first division of labor is that between ordinary shamans who are concerned with the Rites of Passage and weather shamans who conduct the Rites of Intensification. The duty of the latter is to restore the equilibrium of the group in the face of droughts or too extensive rains, storms, or floods, or to predict with reasonable accuracy when the seasons will change. Among the Cape Bushmen, for example, there were special rain-making shamans, held in much higher repute than those who were healers. In time of drought when game was unusually scarce, the rain-shaman would go out onto the grasslands to kill a bull-eland. When he had secured one, he would drag its carcass over the ground with the help of others. Wherever they dragged it, it was believed rain would fall, providing that the ritual had been properly conducted.

Throughout the grasslands of the Sudan and East Africa, where rain is of prime importance for the pasturing of flocks and for agriculture, the rain-shaman, or rain-priest, is the religious official of highest rank, what-

ever the outward form of the religion. Even among Mohammedans, the heads of the religious hierarchy take over rain-making duties, as is the case with the Emir of Sokoto. In pre-Soviet Russia, where a drought in the summer might ruin the wheat crop of the Ukrainian grasslands, the Orthodox Christian priests habitually conducted rain-making ceremonies.

A second cleavage in the ranks of priests is that between diagnosticians and healers. Among such peoples as the Araucanians, the Chibcha of Colombia, the Creeks of the American Southeast, and many of the Negro tribes of West Africa, when a person is ill, a diagnostician-shaman is first called in to examine the patient, and his task is to find out what caused the illness. In case of death, he may conduct an autopsy to find out the cause from the shape of the internal organs, or from the presence of foreign particles. The diagnostician is thus also a detective. Sometimes his report merely consists of naming a person who may, in his opinion, have brought about the disturbance (illness or death) by performing evil magic (ritual techniques). Whether or not the accused actually practiced these techniques, the patient's relatives will deal with the accused appropriately, either killing him or driving him away from the community. Needless to say, the shaman selects someone whose interaction rate has disturbed the equilibrium of the group in the past; the accusation directed at a troublemaker is plausible and the action taken is satisfying to the group. The equilibrium of the group is thus restored. The punishment of scapegoats of this kind is an important element in many Rites of Passage, as we shall see in Chapter 20.

Where certain ailments are associated with different institutions, there may be a division among the healers. Among the Omaha, whose war activities involved a complex institution separate from the family, wounds were treated by buffalo doctors, persons who never dealt with illnesses. The Mano of Liberia have expert bone-setters, who do nothing else. In the West Coast region of Africa, there is a great proliferation of ritual specialists; circumcisers, scarification-cutters, and men who specialize in every recognized disease.

As societies grow more complex and numerous institutions arise, priests tend to form their clientele from particular institutions. Some shamans are primarily concerned with crises within the family, such as those caused by illness; and hence their clientele is made up of members of families acting as terminal groups. Others develop followings within economic institutions. In Polynesia, for example, specialists developed who were concerned with canoe magic, others with fishing magic, and still others with garden magic.

Among the cattle-raising peoples of East Africa, there were experts who specialized in the ailments of cows.

As shamans become increasingly specialized, each class of specialist handles a narrower field of ritual techniques, and can elaborate within it. When this happens, the chances that they will hit upon some techniques of scientific value become greater. Some of the techniques which they learn to use in this way will serve not only as symbolic mechanisms by which they can restore equilibrium to their clients, which is their primary function, but may actually provide the shaman with medical cures, accurate methods of diagnosis and accurate ways to predict eclipses or to foretell the advent of the rainy season.

The performance of techniques of this kind, based on chance discovery and trial and error, formed the basis for the development of many of our learned disciplines. Among these may be numbered pharmacology, surgery, general medicine, astronomy, the development of calendar systems, and much of the higher mathematics. Teaching was also an outgrowth of the duties of the religious leader, and as the empirical content of learning increased, it became increasingly divorced from the practice of ritual.

The Rise of Religious Hierarchies. When the equilibrium of an individual is disturbed by a change in the interaction rate of one or more of his relationships, a compensatory movement takes place by which he tries to restore his equilibrium. Sometimes, these movements take place within his existing system of relations, but more frequently, in the life crises, they involve setting up or increasing his relations in a religious set. During a serious illness or upon the death of someone with whom he is accustomed to interact at a high frequency, his compensatory relation to the priest may provide all the adjustment necessary to restore his equilibrium. If that is the case, a permanent relationship between the individual and the priest will be built up, which must be maintained if he is to remain in this state of equilibrium. He will thus need to be constantly near the priest in order to interact with him, and, in short, will become a member of his following. Through his influence, tangent relations may be established between the priest and members of his family, and they, too, will become members of the religious set. On the other hand, if the stability of the family system is great, the religious disciple may decrease his interaction with the members of his family and obtain his equilibrium by interacting with the priest and other members of the religious system. On the contrary, the pull of the family system may be stronger, and once the crisis is past, the frequency of interaction with the priest will decrease until it returns to

its state prior to the disturbance. In such a case, the priest has served as a transitional, stabilizing force.

Out of situations like the above are built the complexities of religious hierarchies. If individual crises are the only ones having any frequent incidence, and groups themselves remain relatively stable, there is little probability that widespread religious institutions will develop. Every shaman will have his following, but he will be a personal leader much like the Mumis, with whom we dealt in the chapter on political institutions. Even if complex ritual techniques arise, consequent upon the development of complexity in the technology and in existing institutions, the division of labor among priests is the principal result. In complex cases, several different specialists may be called in, but little more than a processing set with a low frequency will be found, with diagnosticians, for example, originating to healers. At this stage of complexity the clientele interacts with the priests at a relatively low frequency, and there is a good deal of shopping around from leader to leader.

The development of complex religious institutions is based not upon crises involving the individual, which are dealt with through the Rites of Passage, but rather upon an increase in frequency of the Rites of Intensification, which are used to stabilize the equilibrium of the entire group. In these rites, the leader originates to the members of the group, conducting ceremonies having to do with the principal sources of livelihood. Among the Omaha, for example, as we shall see in Part IV, the Rites of Intensification involve the principal sources of food, the techniques concerned with hunting the buffalo and raising corn. Among these people, the whole tribe responded to the origins of the priests in charge of the ceremonies, and it is significant that these priests were non-voting members of the tribal council, whose voting members were, as we have seen, the Seven Peace Chiefs, while the healers, who dealt with individual sicknesses, were not. In other words, the members of the tribe terminated in set events both to the Keepers (priests) and to the Peace Chiefs.

Among the agricultural peoples of Europe and the Near East the great ceremonies were those connected with the planting of grain and the harvest. The Easter services which were common to the cults of Isis, Mithra, and Astarte, and later of Christianity, were the spring-planting festivals of these agricultural peoples. The priests who conducted these ceremonies were, therefore, concerned with the control of complex technological procedures and the institutions in which these were important.

The growth of great religious hierarchies, though based upon the leaders who conducted the Rites of Intensification, did not attain the dimen-

sions of the cults above mentioned until the development of trade and urban civilizations had extended the existing system to large groups of people. Ordinarily their rise is associated with the rise of political hierarchies. In some societies, the political leader was both king and priest, but this was possible only in relatively isolated systems such as Egypt and Peru, for any long period of time. In other places, as in England, the king might be the head of the state church, but there were other religious institutions independent of that religious system.

Once such a system of relations had developed through trade, conquest or both, the ground was ripe for the development of complex religious institutions. Because of the place of religious leadership in the lives of individuals, the rise of religious institutions is associated with periods of disturbance in the systems of relations of people. We have already dealt with an instance of this in the Taro cult of New Guinea; and the spread of the Ghost Dance and the Peyote cult among the American Indians are classic examples among the simpler peoples. But the cults of Mithra and Isis and the final development of Christianity were also dependent for their growth upon disturbed conditions. In the case of Christianity, the first great spread was coterminous with the Roman Empire, and, as everyone knows, it was coincident with the disturbed conditions which ultimately resulted in the fall of that empire. When a church develops on a national or international scale, the need for administration automatically results in a hierarchical control, but the degree to which this is exercised is dependent upon the complexity of the institutions in the groups in which it operates.

Since religious hierarchies are based upon the Rites of Intensification, we find that the set events in which the religious leaders originate to their followers occur in accordance with changes in the rate of interaction in the group, the disturbances that result from the cycles of activity imposed by technology and environment.

In all religious institutions which have developed complex sets made up of several hierarchical levels, such as the Christian Church, the Tibetan Theocracy, or the Brahman Churches of India, we find daily, weekly, monthly and yearly rounds of ritual, which, however varied they may be in the techniques employed and in the symbols used, have in common the fact that they bring about habitual interactions between the priests and the members of their congregations. Within this cycle, there are marked variations in frequency and in duration of the interactions involved, which are consequent upon the importance in amplitude, of changes in the equilibrium of the individuals in the group. In the Christian churches, the length of the services and the number of events taking place within them vary from

the shortened services often held in the summer to the elaborate and long-continued rituals of Christmas and Easter. Moreover, special services are held on days immediately preceding these great festivals, and the frequency of the events which occur in the preparation for these festivals, including not only the ritual itself but also the activities of the members in preparing costumes, decorating the church, and the like, builds these ceremonies up to a maximum intensity. We will discuss changes of this sort in Chapter 21, but it is important that the reader realize at this point that at such times it is not only the interaction between the priests or ministers and their congregations which is increased, but also the events which take place between all the members of the hierarchy. In response to the tempo of events, there is a coincidental increase in interaction between the higher classes of the hierarchy, which are passed along the line. At this time the head of the set originates to all below him, thus maintaining his position in the set in respect to all those who terminate to him. The Pope, for example, issues a proclamation at Christmas and Easter, and the faithful in the Church can read his words in the newspapers or hear them over the radio.

Within the framework of these regular events in the ceremonial calendar, the religious institution becomes elaborated. Not only does the priest originate in set events in these Rites of Intensification, but he also controls in greater or less degree the crises connected with the individual, the Rites of Passage. In most societies, some of the individuals who act as specialists in the life crises remain outside the religious hierarchy, which is organized around leadership in the Rites of Intensification. In Dahomey, for example, midwives and diviners are not part of the great religious cults. In our own society, doctors and nurses are playing increasingly important parts in the crises affecting the individual. But even so, some part of the interaction involved in stabilizing the equilibrium is performed by religious leaders. In our own society, too, the Rites of Intensification are no longer entirely in the hands of the religious hierarchies. The scientist and engineer start off many events which used to be performed by the priest. In agriculture, for example, the U. S. Department of Agriculture provides technical leadership even though the churches still celebrate the principal agricultural festivals.

Nevertheless, the complex religious institution, like the complex political or economic institution, tends to take over more and more control of its individual members. In so doing, sets similar to those found in the latter institutions develop. The religious set becomes elaborated on the basis of geographical regions just as does the administrative set in the political institution. In the Catholic Church, local groups headed by parish priests are

combined into dioceses or episcopal sees, under bishops, and these are in turn combined into wider territories under archbishops. The Catholic world is divided into seventy areas under as many cardinals, all under the leadership of the Pope, who is elected by the College of Cardinals from the hierarchy.[5] (This makes up a limited representative set.) Over each stage in this system is a head, and the hierarchy ordered in the religious sets forms a series of stages in the Class B of the set; the Pope is the sole representative of Class A, and the lay members of the church form Class C.

The members of this religious set are then differentiated into other sets, particularly in a staff-line set, the members of which are the religious orders who originate to the system of parishes which makes up what is, in effect, the line organization. The religious orders include such groups as the Jesuits and the Franciscans. Members of these orders furnish the teachers for the parochial schools and colleges, the missionaries and the research staffs of paleontologists, anthropologists, seismologists, and so on, whose duty it is to keep the church informed of the progress of science and thus enable it to maintain its tangency with other institutions as conditions vary.

Between the various divisions of the church there are habitual orders of interaction in the staff-line set which prescribe the relationships of individuals in different parts of the organization. For example, if a parish has church schools, the local priest supervises them directly, but the nuns who make up the teaching force are members of a religious order and hence under the direction of their superior. If a priest wishes a change in personnel in the teaching staff, he must originate to his immediate superior and so on up, until the person who is also over the teaching order is reached, and then down again to the nuns. However, in ordinary matters concerned with teaching he can originate directly to the nuns in set events, thus forming with them a staff-line set.

In different churches the frequency of events within the various sets differs just as it does in a family or a political institution, and it varies also as a consequence of the differences in the interaction rates of the individuals who make up the system. As a result of the interplay of set and pair events, each religious institution develops a state of equilibrium which represents the adjustments of the different individuals to one another within the institution. These differences in equilibrium are responsible for the variations in adjustment of a religious institution such as a church under the stresses of changes in tangent systems. A few brief examples will illustrate this interdependence, which is part of the general subject "The

[5] The cardinals represent not only regions, parishes, bishoprics and archbishoprics, but also the religious orders.

Interrelationship of Institutions" which will be discussed in Chapter 18.

In the urban civilizations of Europe during the fifteenth to seventeenth centuries, the rise of economic institutions brought about marked changes in the organization of religious institutions. The economic leaders were accustomed to originate action within their institutions, and they were engaged in a constant struggle with the leaders of the political institutions. The high frequency of the tangent relations of religious and political leaders was a source of serious disturbance to them in their efforts to maintain the equilibrium of their economic institutions. The result was the Protestant movement directed towards the formation of religious institutions separate from the Catholic Church and under the control of the economic leaders. The forces operating were reflected in the organization of these churches. The ministers were chosen by the parishioners, and in those churches which most completely represented the merchant class, the representative set developed a high frequency similar to that in the democratic type of political institution. Needless to say, the two types of institution historically accompanied each other in the same societies.

In some places, as in Tibet, in Rome during the Middle Ages, and in early New England, the church took over the functions of the political institutions. It formed the state because the external relations set included all the members of the total system. When this happened, lay political officers formed staff organizations in the religious hierarchy. Army, police and similar political systems were responsible to the religious leader. This development again, like those just mentioned, was the result of the interrelationships of institutions tangent to the religious system. And in the next chapter we shall consider in more detail how this operates.

SUMMARY

Religious institutions arise from the establishment of sets in which one individual originates to others in times of crisis to restore equilibrium. These are internal crises and hence the religious institution needs no external relations set; the basic set is the *religious* set, between priest or shaman and his clients. The priest or shaman does not lead the people against the members of another group, but he leads them in situations of profound emotional disturbance, the causes of which are usually not understood by the persons involved.

There are two kinds of such crises: (1) those in which the disturbances are caused by changes in the relations of a single individual to others when he becomes ill, dies, is married, etc.; (2) those in which the whole group is affected by some disturbance, as for example by a seasonal change in

activity due to changes in the environment. In disturbances of both kinds the interaction rates of the people have to change, and the ritual techniques used in these rites, called respectively the Rites of Passage and Rites of Intensification, build up the new interaction rates needed to restore equilibrium. When these two kinds of rites are performed outside the family system we have the beginnings of a religious institution.

The religious leader must be able to originate in set events by means of those techniques which have the greatest effect on the autonomic nervous system, such as those which involve a regular rhythm, in music, dancing, verse, etc., and in which the congregation may respond as emotional reactions become intense. The priest must have these qualities of accurate timing if he is to restore equilibrium, and therefore a priest is often a psychotic or neurotic, among whom these characteristics are often exaggerated. The effect of the priest's rhythm is to produce a state of emotional excitement in which the individual is operating almost completely under the control of the lower centers of the brain.

Religious leaders are usually selected for these qualities, and go through long periods of training. In the more primitive societies the priest begins by building up a clientele of followers, to some of whom he may have ministered in illness, while others are individuals whom he has restored to equilibrium in other crises. As societies increase in complexity, the priests, like other people, become specialized; the first division is between those who conduct Rites of Passage for individuals, i.e., healers, and those who conduct Rites of Intensification for the group as a whole. These latter are often weather shamans, or rain-makers, who officiate in major disturbances such as those caused by drought. A second split comes between diagnosticians and healers. The diagnostician may not only diagnose illnesses, but he will also in many societies find a scapegoat in cases of major disturbance. For example, when a chief dies he will find some person whose rates cause disturbances, accuse him of evil magic which produced the chief's death, and have him put out of the way.

As different kinds of shamans and priests specialize more and more, and as religious leaders build up steady relations with their clients, elaborate hierarchies arise, which develop elaborate administrative, and in some cases staff-line and processing, sets. Such an elaborate religious hierarchy may come to regulate the performance of all technological activities of a people, and they may even take over the administration of the state. The rise of great religious hierarchies is usually associated with the rise of elaborate political institutions, and very often the head of one will also be the head of the other.

CHAPTER 17

Associations

I. THE DEVELOPMENT OF ASSOCIATIONS

Within any institution, the adjustment of the members to one another represents a balance between their interaction rates. When a disturbance from the outside causes compensatory changes in the institution, it tends to return to its previous state of equilibrium once the disturbance is ended, provided that the disturbance was not of too great an intensity nor of too long duration. During the period of disturbance, however, while the members are trying to adjust themselves to the new situation, there is a marked upset in the equilibrium of each individual. He is unable to interact at his accustomed rate, and hence is upset. Under these conditions the interaction rates in the system vary considerably as the different individuals in the system attempt to restore equilibrium. This keeps up until the disturbance is over.

Disturbances of this kind followed by restorations of equilibrium are so common in every society that they are seldom recorded. Oliver, however, gives us an example from Siwai in Bougainville, as follows. During the preparation for the Social-Climbing Feast, which we have already described, a man named Ho'oma was a very hard and faithful worker. Songi (whom we have met before) began to depend more and more upon him, and as a result of this increase in interaction between Songi and Ho'oma, Ho'oma increased his interactions with other natives who had previously been in an equivalent position in the Songi set. Thus Songi gave orders to Ho'oma and Ho'oma in turn gave orders to the other natives. During this period, in order to give more time to the supervision and execution of Songi's orders, he very often slept at the men's clubhouse, returning home only for meals. This decrease in interaction with his family disturbed his wife, who increased her interaction with him whenever he appeared, acting with a high frequency. She railed and screamed at him, and while he was with her they squabbled intensely. After one of these quarrels had disturbed Ho'oma deeply, he went away for a week and interacted only in Songi's system, in which he obtained a satisfactory and balanced interaction

rate. During this time, the wife forced her lazy sons to do more work than they were accustomed to doing. As Oliver says, "We would sum up such a situation by saying that Ho'oma had little time for his family, and this change was reflected in changed relationships within the family." After the feast, when there was no longer any need for his services, Ho'oma slid back into his old routine and peace descended on his family.

The trouble narrated above was caused by Ho'oma's increase in interaction in a tangent institution, the Songi political set. Ho'oma's wife, who was the person principally affected, tried to compensate for the decrease in interaction with her husband by increasing her origins within the family; to her sons, and to Ho'oma himself when she could get hold of him. Very often, however, people who have trouble in one institution make their adjustment by an increase of interaction in other systems. Thus an American woman who has the same kind of difficulty with her husband might go to the hairdresser's more often, visit her friends, increase her attendance at church, or join the Women's Fire Brigade. If a man at breakfast receives a tirade from his wife, who thus originates to him at an unaccustomed frequency, he may speak to no one on the way to his office, and when he arrives there he may order his staff around with what seems to them unwarranted violence. Examples of this kind of situation might be multiplied indefinitely. The point here is that compensation for disturbances in one institution is often made automatically by changes of interaction rate in another.

So far we have been dealing with disturbances of a temporary character, but, as we have seen in Chapter 16, there are many disturbances which cannot be removed and which bring about permanent changes in the equilibrium of individuals and of systems. The commonest disturbances of this kind are the "crises" which we have previously described, including birth, puberty, marriage, illness, and death. There are many others, however, such as the loss of a job, which puts a man out of an economic institution as much as if he had died; or a promotion in a political hierarchy which raises him from Class B-2 to B-1, or from B-1 to A, etc.

When a disturbance of this kind has taken place, there are two automatic mechanisms by which the equilibrium of the affected system may be reestablished on a new level—a Rite of Passage, conditioning the individual to new adjustments within the institution, and a shift in the relations of the disturbed individuals in tangent institutions. Where there is but one institution, the entire burden of readjustment has to be borne by ritual, but where there are many, as in our own society, much of the shock may be absorbed by readjustments in tangent systems.

For example, if an author's wife dies, he may compensate for the disturbance in his family system by going on a lecture tour. If, however, the individual in question is a business man and not an author, and if he belongs, as many business men do, to a complex economic institution, his increased origins in the office may disturb other people, and he may lose his job. It may be that there is no other institution in which he habitually interacts that can absorb his change of interaction rate.

Then again, let us take the case of a man who has not lost his wife, but has retired from business while still young enough to interact at his usual rate, and with enough money to do as he likes. In this case again, the man will need some outlet for the amount of action which he formerly originated in the economic institution and which would upset his family system if directed at his wife and children, with whom he is already in adjustment. He must find a system in which to interact or he will be in serious difficulty.

Individuals who need to interact with someone to compensate for disturbances in the institutions in which they have habitually interacted, do so along channels already in existence. An individual who finds himself in this predicament will therefore try to find someone with whom to interact, and this person will be someone with whom he has something in common to serve as the basis of interaction. A dog-breeder who moves into a new state or new part of the country will seek out other dog-breeders and join their association; a man who sails boats for pleasure will try to join a yacht club. As we shall see presently, a parent whose relations with her child are upset may join the Parent-Teachers Association.

What this means from the standpoint of our analysis is that the disturbed individual will secure an adjustment in tangent relations. Either he will begin to interact at a relatively high rate with individuals with whom he already has tangent relations through a third person or institution, or he will build up such tangent relations through the medium of a common technique. Now when a number of persons have established tangent relations with each other, and have begun to interact regularly on this basis, it is easy for a leader to develop a following on such a basis. The system thus formed is called an *association.* It must be remembered that, whatever the other characteristics of an association, it is always formed at the point of tangency of several institutions, or of sub-systems within an institution. One of the clearest and simplest examples of this kind of institution is the Parent-Teachers Association in almost any American community.

Associations and the Tangency of Institutions: The Parent-Teachers Association. In the case of the Parent-Teachers Association we have two

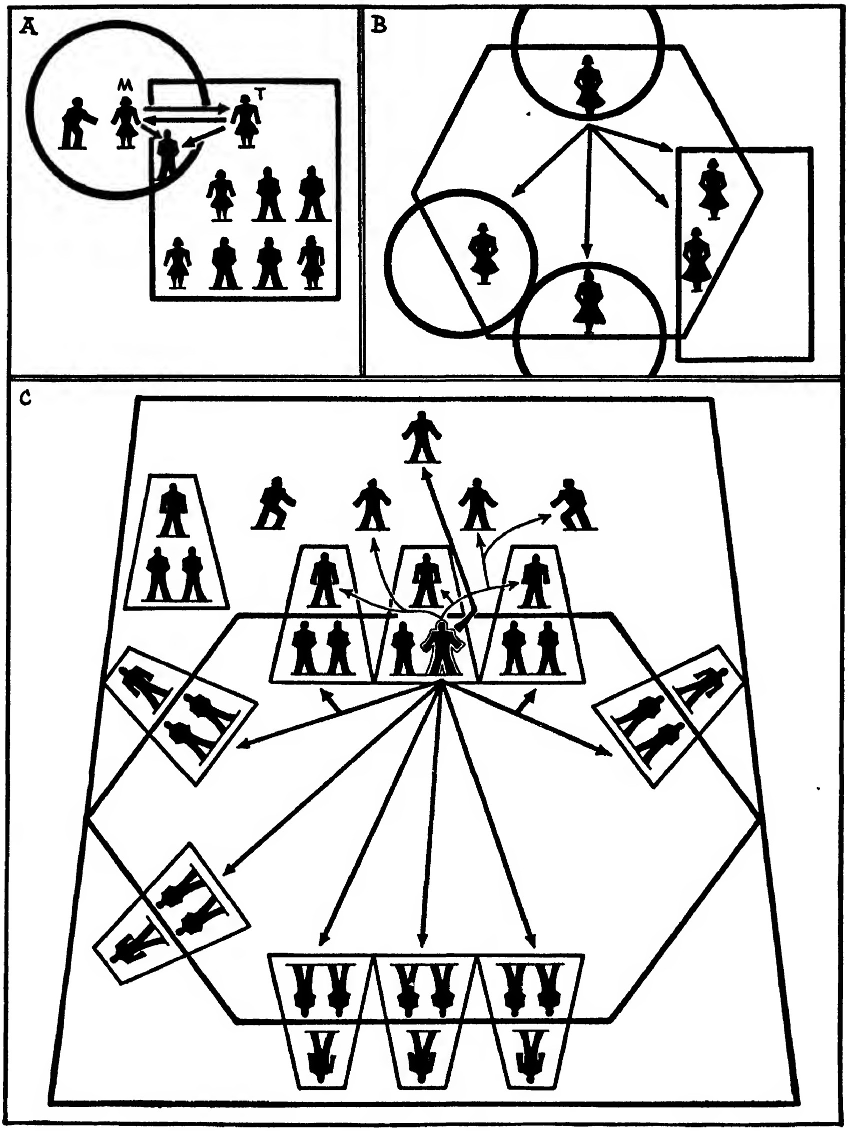


FIG. 12. ASSOCIATIONS. For key to symbols, see Figure 3b, page 284.

(A) A TANGENT RELATION. Mother and teacher have a tangent relation through a boy in school.

(B) THE PARENT-TEACHERS ASSOCIATION. Mothers and teachers belong; one of the mothers is president.

(C) A LABOR UNION IN A FACTORY. Members of Class C of all departments belong to the union. The members of Class C of staff departments, such as bookkeepers, do not belong, because they are not in tangent relations, through the foremen, with the others.

systems: the family and the school (a sub-system of a political system), which are tangent to one another due to the fact that the parents originate to the children, to whom the teachers also originate. The child, therefore, stands at the point of tangency between the two systems, and the tangent relations are between the parent and the teacher. Quite often the parent may originate action to the teacher by coming to the school to talk over little Johnny's problems, and in turn the teacher may come and ask the parent why the boy is so badly behaved. Thus between each parent and the teachers of his or her children there grows up a tangent relationship which may involve considerable interaction.

Once some disturbance in these habitual rates of interaction takes place, individuals arise who organize the parents and teachers into a habitually interacting group. By so doing, the unstable tangent relations between parents and teachers, which derive from difficulties in adjustment of the school and family systems, are stabilized by the development of a new institution, the Parent-Teachers Association, which restores these relations to a state of equilibrium. As anyone with any experience in these associations knows, the institution, which builds up a system of habitual interaction between parents and teachers, acts as a very obvious compensatory mechanism. In fact, often the teachers feel that the active membership is almost entirely made up of parents whose children are having difficulties at school. At the meetings of the Parent-Teachers Association, these parents compensate for the disturbed relation between teacher and child, which has in turn disturbed the relationship between child and parent, by causing the latter to originate with a high frequency to the child's teacher.

In most cases, on the other hand, the behavior problems in school represent the child's attempt to compensate for disturbances in the family system at home. Nevertheless, even though the parents may often originate to the teachers at the Parent-Teachers meetings, a certain amount of adjustment between parents and teachers does occur, which is increased by the fact that both parents and teachers terminate in set events to the officers of the Association. This action has the same equalizing effect that we have already seen at work in religious institutions. Moreover, these associations, whose members are originators in the representative set of the political system, are often able to bring pressure on the school committees or city councils, which in turn brings about changes in the school system.

It must be emphasized that the association consists of an organization of people who are in tangent relation to one another; it does not consist of the people who are at the point of tangency. The Parent-Teachers Association is formed of teachers and parents, and does not include the children

who are both pupils and sons or daughters. Both teachers and parents are in equivalent positions, they both originate to the children in different systems.

Associations Derived from the Tangency of Sub-Systems: Labor Unions. All associations are derived from tangent relations, but not all these relations hold between members of separate institutions. In the case of large and complex institutions divided into many departments, each of which forms a sub-system, associations may arise at the points of tangency between the departments. A sub-system, of course, represents a group which is quantitatively isolated from other parts of the institution; ordinarily there is a higher frequency in the supervisory set, i.e., the boss of the department originates much more often than any of his immediate superiors to the members of the department. Thus the office employees of a manufacturing company may form an association and go on outings; they all have tangent relations with one another as fellow members of the production or shop departments in the company.

The division into departments, however, is not the only way in which sub-systems develop within institutions, nor is it the most important from the point of view of the size of associations. In many organizations, we find a line of cleavage (isolation) at the "work-level," that is, between the workers and their supervisors. The workers occupy the terminal class in the supervisory set and they are also interrelated in terms of the processing and staff-line sets in different ways. If there is a high frequency in the origins of action by management to workers in the supervisory set, the workers develop tangent relations with each other through the members of management. The situation is, therefore, similar to the Parent-Teachers Association except that the order of interaction is reversed. In the Association, both parents and teachers form tangent relations to one another because they originate, in different institutions, to the children; in the case of the formation of a labor union, workers in the same or different departments form tangent relations with one another because they both terminate to the same people, i.e., the members of management.

If changes of frequency arise in the relations of workers and management which seriously disturb the equilibrium of the workers, the frequency of interaction in the tangent relations of worker to worker increases and an association results. The institution so formed acts as a compensatory mechanism. The leaders of the union form a supervisory set in which the other members are termini, and an external relations set develops in which the workers originate to management.

In such an association, compensatory movements operate through the

sets which have developed. Aside from the external relations set and the supervisory set, an important set is the representative set, through which the workers choose their officers. When origins of action increase in the factory from management to workers, the compensatory movement takes place in the representative set in the unions as the workers originate to their officers, who in turn, in order to compensate, originate in the external relations set to management. Where frequent disturbances in the relations of management to its employees occur, the compensatory origins by the union will be high, and conflict common. But after a period, the conjoint system will attain a state of equilibrium which will differ from factory to factory, depending upon the quantitative properties of the interaction rates of the individuals in question. The stability of the system, and its effect in stabilizing the mutual relations of the two institutions, depend upon the degree to which minor disturbances are dealt with by the leaders of the two institutions. A labor union or any similar association involving tangent relations between individuals who terminate to a common group provides for a single institution the same compensatory system which the democratic, representative system provides for the combination of institutions making up the total system of a people.

Associations and Secret Societies. In the study of associations, the subject of secret societies is often dealt with as if they formed a special type of institution different from associations. This is because of the emphasis in the literature upon the aspect of secrecy. As a matter of fact, the attempt to use secrecy as a criterion for institutional differentiation is of little value. Secrecy implies the isolation of the members of the institution from non-members when the former are interacting. Organizations which require a high degree of secrecy meet in isolated spots or in houses closed to the public, and may very often have special officers who see to it that no outsider can interact with any of the members during the time of meeting. By the use of this technique about which we will have more to say in Part IV, we find that the members of a system are able to interact without disturbance to their habitual rates of interaction. As we shall see in Part IV, organizations which employ this characteristic isolation of its members during periods of interaction, are those in which the habitual pattern of interaction is highly complex and regular. They are ordinarily those institutions in which ritual behavior, which supplies the techniques which induce these complex patterns of interaction, is very common.

The fact of the matter is that secrecy, which may be defined as the enforced isolation of the members of an institution during some or all periods of their interaction as members of the system, is not confined to

associations, but is, in fact, present in greater or less degree in every institution. Many activities within the family, as, for example, sexual relations between the parents, are conducted in secrecy. Details of technical processes in economic institutions are very often kept from the public, and political deliberations may very frequently be kept secret. One often reads in the accounts of the meetings of political organizations that before a hearing the committee met in executive session, which means that no outside individual was allowed to be present. In churches, for example, many rites are performed only in the presence of initiates, although some activities involve the interaction of the members of the organization with outsiders. Some of the best-known secret organizations are religious institutions, as, for example, that of the Druses of Syria.

Secrecy, then, cannot be regarded as a diagnostic of associations, and the confusion that exists in the literature can easily be seen when it is realized that age-classes of boys in Australia going through their puberty ceremonies have been called secret societies, simply because the Rites of Passage include an element of secrecy. Such a label has been placed on other kinds of institutions for the same reason.

Associations and "Voluntary" Membership. We can perhaps help further to define associations if we eliminate one more false concept which is habitually attached to them. This is the idea that, by definition, membership in associations is voluntary, and that this is not the case in other institutions. It is true that in many institutions membership is an automatic procedure; one is born into a family, and residence in a particular area often makes a person a part of a political institution. Membership in associations, however, *is* usually attained by joining, and that is why it is usually considered to be voluntary.

This criterion, however, does not stand up against the evidence from a large number of societies. In some cases, as in Melanesia, adoption, not birth, is the principal factor in determining family membership, and on the other hand, there exist associations in which membership seems to be obligatory. This is particularly true in some of the curing societies among the American Indians, where membership in one or two instances seems to be automatic. Another weakness of this criterion is that other institutions, including many economic and religious systems, are also joined voluntarily; when you buy goods from a shopkeeper, you are a member of his institution.

The principal difficulty of using such a criterion as voluntary membership in defining an association is that voluntary membership itself is hard to define. Anyone who responds to the origins of action of a leader in any

institution is, for that moment at least, voluntarily included in his set of relations. Nevertheless, membership in a system depends upon the establishment of a continuous rate of interaction, and the quantitative characteristics of this rate vary in different institutions. In some associations, a single event is enough to make an individual a member. In other cases, a long and intensive period of initiation must be undergone before the individual is considered to belong. But membership in this sense, and, in fact, this is the only sense in which it can be used, can only be defined in quantitative terms, and the amount and frequency of interaction needed for membership varies in different associations, as these associations differ from each other.

II. THE DEVELOPMENT OF COMPLEX ASSOCIATIONS

The development of complexities in the structure of associations depends on the strength of the forces operating on the individuals who are tangentially related. If a large number of people occupy tangent relations in which they are tangent through relations in the same institution, then large associations will be formed, and they will develop all the characteristics of the institutions we have already studied. A good example of this is the American Legion. It is made up of local Posts with county, state and national units, organized in the same way as our political system. Within each of these organizations, each having its own officers, there is a number of committees which supervise the activities of the individuals included within that part of the system. Because it depends upon tangent relations through service in the American army during the last war, the membership runs into millions. In such an organization, the same sets found in the political organization are present: representative, supervisory, processing, staff-line, and external relations, all based on tangent relations. The formation of the American Legion was similar to that of other types of institutions. A small group of men started it and built up a following. The disturbance in the equilibrium of the returned soldiers after the war was so great that the association spread like wildfire, much like the spread of religious institutions discussed in the last chapter.

Such associations are not confined to our own civilization. In the Banks Islands, the Sukwe societies, which were based on a combination of the exchange of wealth and age-grading, had equivalent chapters in different islands, totally independent of each other politically. These villages and islands were similar in regard to institutions. The same is true in Liberia of the Poro Society; members of the upper grade could go from tribe to tribe and be received by the members of the equivalent institution, just

as fraternity brothers can go to the house of their fraternity in different American colleges. National associations may, however, split up and separate if the tangent relations between sub-divisions decrease in frequency.

At Harvard University, where isolation from other colleges has markedly increased, many of the national fraternity chapters became, during the early twentieth century, independent associations. Here it is to be noted that the most exclusive clubs came to be made up, in large measure, of individuals in tangent relations to each other through the family system, while the less exclusive ones, which remained national in scope, failed to take on this linkage.

Fundamentally, associations present the same picture with which we have already dealt at considerable length in the case of other institutions. The simplest case is the group of four or five individuals who form a club, or the girls in the eighth grade who are in Miss Jones's room. The most complex is the association like the Legion or the Masons, with a complex hierarchy involving many levels in the sets and a large number of interrelated sub-systems. Wherever they occur, however, they are dependent upon the need to stabilize the equilibrium of individuals, and they run along the line of tangent relations between members of institutions. They present all the characteristics of other institutions: the struggles for leadership, the development of sub-systems and the splitting off of association from association. They possess, however, one characteristic which reflects their significance for maintaining the equilibrium of individuals. Among peoples where change is ordinarily frequent and associations develop, there is no limit to the number to which an individual can belong. Ordinarily a man interacts in one extended family system, one church, one political institution, and one main economic institution. But if there are many associations, he may, within limits of his tangent relations and his capacity for interaction, belong to a very large number. Active "joiners" in our society may easily belong to sixty or seventy, in all of which they interact to a certain degree. The implications of such a system in maintaining the stability of a total system will now be considered.

III. THE DEVELOPMENT OF GROUPS OF ASSOCIATIONS

Associations develop, as we have seen, from tangent relations in every institution. Very often two institutions may be involved in the development. Once the process of forming associations begins to take place, we find that a number of different ones will form around many of the tangent relations in a society. This is due to the fact that the formation of an association, while stabilizing the equilibrium between two institutions, may

very often accentuate cleavages in others; and thus create a need for other associations.

The process of development in associations, therefore, often proceeds in waves of activity, in which a group or cluster of associations is formed and brings the total system into a state of equilibrium. In order to illustrate how this happens we shall give two examples: the associations of the Omaha Indians and those of the inhabitants of a small city in New England.[1]

Omaha Associations. We have already briefly considered some of the institutions developed among the Omaha Indians in the Great Plains of the United States. Aside from the economic system, which we discussed in the Buffalo Hunt, in which the hierarchical organization consisted of the hereditary leader of the Buffalo Hunt and the soldiers, the hunters and the meat cutters, we also saw that the principal division in the political system was between the Seven Peace Chiefs, the Nikagahi Shabe, and the Appointive Chiefs, who obtained their position by giving gifts to the Nikagahi Shabe and were called the Nikagahi Xude. Aside from these distinctions there were also the distinctions between those who had attained no war honors, those who had war honors of the lower grade, and those who were eligible to wear the Crow.

The Night Blessed Society. On the basis of these systems a number of associations developed, one of the most important of which was the Honhewachi, or Night Blessed Society. Membership in this society was obtained after an individual had made one hundred of the gifts called *wathinethe* to the chiefs. When a man had succeeded in doing this he was eligible for membership. The heads of the society were the Seven Peace Chiefs, and they conferred the membership on the individual after a long ceremony which largely consisted of the recitation of these gifts, what was given and to whom. As a result of membership in this society, a man had the right to have tattooed on his daughter or some other female relative a sacred symbol of the society, which we will discuss in another place. A girl so decorated was called a Nikagahi Wau, or Woman Chief, and such women played a prominent part in tribal ceremonials. This society, of course, was derived from the tangent relations between the political and family systems, and it served to build up the frequency of the relations between a man, his daughter and the Chiefs.

Warrior Societies. Two other associations were formed which were dependent upon the war hierarchy. The first of these was the Hethushka So-

[1] This section is based upon analysis of the evidence presented in Chapple, E. D., *The Theory of Associations* (unpublished), Ph.D. Thesis, Department of Anthropology, Harvard University, 1933.

ciety, which was the principal warrior society among the Omaha. All those who had taken part in war parties and who had won war honors were members of this society. The other society, which was more exclusive, was the Pugthon. This was made up of members of the Appointive Chiefs, who

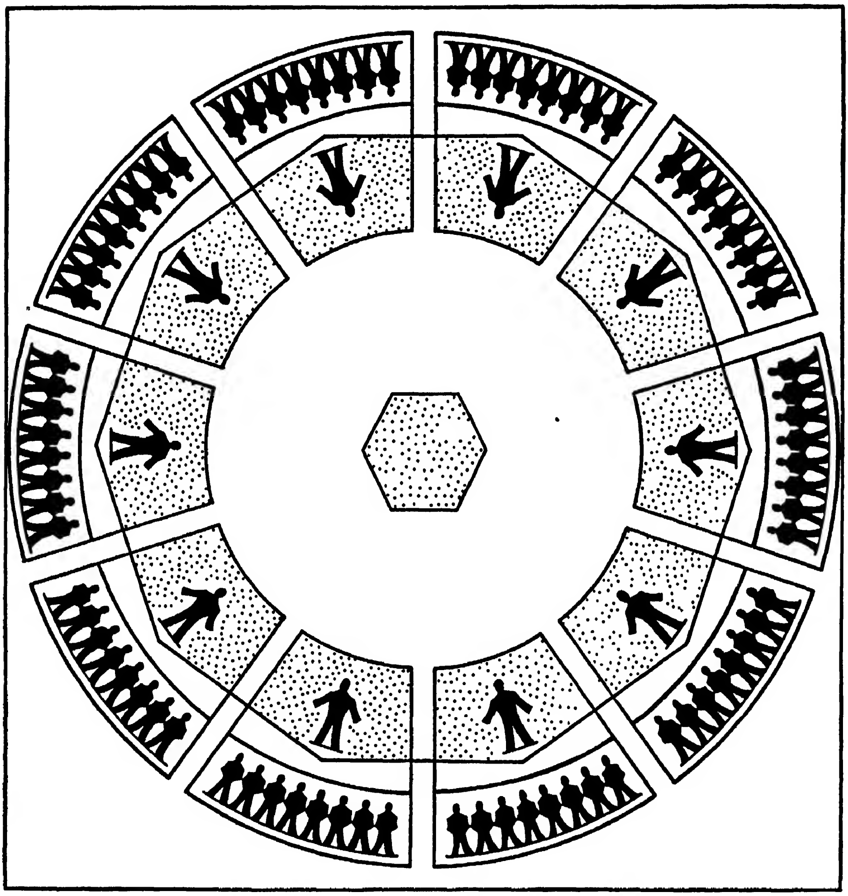


FIG. 13. AN OMAHA ASSOCIATION: THE PUGTHON

This association is made up of the members of the Nikagahi Xude, or Appointive Chiefs, who are soldiers in the annual buffalo hunt. They originate to members of the tribe as a whole in set events. The segments of the circle represent the ten Omaha gentes, of which the Pugthon members are the leading men.

had also won war honors, and as far as can be told from the evidence of the sources, it only included members of the soldier group, whose activities we have already discussed. The tangent relations in this case are between two branches of the political system, the civil and the military, while the

Hethushka is much like the organization of a labor union which is developed out of sub-systems.

Doctoring Societies. One further group of associations must be described. These are the so-called doctoring societies, the most important of which, the Shell Society, did not in fact do any doctoring except among its members. The membership of the Shell Society was made up of the Seven Peace Chiefs and their families. They had a highly elaborate ritual, the significance of which will be discussed in another place, but the ceremonies which involved both men and women were built on the tangent relations between the family system and the political system.

Besides the Shell Society, there was one other society of major importance and a number of subsidiary societies which were tied in with it. These were the true doctoring societies, the members of which were shamans who cured the sick. The sub-societies were merely groups of specialists, and they were officially supposed to be open to anyone who dreamed of the Thunder, of the Grizzly Bear, or of whatever the tutelary deity of the society happened to be. Fortune, however, has shown that membership in these societies and in the parental Pebble Society was really dependent upon the inheritance of doctoring powers within the family.[2] These societies were built up from the tangent relations between shamans, the patients forming the point of tangency.

It is not clear whether the Pebble Society was formed first and the others were the result of internal divisions, or whether the Pebble Society represented the later coordination of these doctoring societies. In any case it is important to point out that members of the Shell Society could not belong to any of these other doctoring societies, and this is in accord with the division between the Seven Peace Chiefs and the Appointive Chiefs, the latter of whom furnished many of the members of the doctoring societies.

The Interrelation of Omaha Associations. These associations among the Omaha were formed along the sort of cleavage lines which we discussed in the case of the labor unions, and the associational system represents a system of mutually dependent associations which are interlocked with the family and with political and economic institutions. The high frequency of interaction between the Seven Peace Chiefs produced disturbances in their family systems, since, in cases of crises, they met with great frequency. Prescribed interaction in the Shell Society was a compensatory mechanism which served to stabilize the equilibrium between the Chiefs and their families. One of the principal lines of cleavage was, of course, that between

[2] Fortune, R. E., *Omaha Secret Societies,* New York, 1932.

the Shabe and Xude orders, which was maintained in the Shell and Pebble Societies. This was dependent upon the fact that the Seven Peace Chiefs, if they had been members of the doctoring societies, would have been placed in the position of termini in the doctor to patient hierarchy, and the high frequency characteristic of this system would, if they had been included, have disturbed the political system.

The other principal split came between the members of the doctoring society and the ordinary individuals in the tribe. The disturbance to the doctors came as a result of their clan relations with their patients. The tangent relations of doctor to doctor through their patients stabilized their equilibrium and strengthened the doctor-patient set.

The Night Blessed Society served to stabilize the mutual relations of the Xude group (the Appointive Chiefs), or gift-givers, who interacted in tangent relations with the Seven Peace Chiefs through other individuals in the tribe. It also brought the females into its system, and thus helped stabilize their position in the family in the following manner. A member of the Appointive Chiefs was almost always a man who had "made his count" of a hundred *wathinethe,* which entitled him to membership in the Night Blessed Society, made his daughter a Nikagahi Wau, and entitled her to participate in their activities. Now the other distinctions of a chief, such as his doctoring privilege and his wealth, were inherited by his sons and could be passed on during his lifetime, but his daughters were in a position no different in these respects from the other women in the clan whose fathers were in no way distinguished. Hence the membership in the Night Blessed Society gave these women the opportunity to originate action on many occasions, and thus prevented a cleavage between the female and male lines. The final group of stabilizing associations consisted of the warrior societies. The Pugthon was an association made up of the soldiers who were tangent to one another through their relations to the Seven Peace Chiefs and the hereditary leader of the buffalo hunt. The members of this association maintained their relations to one another at a stable frequency during the periods when they were not active in their official positions. The Hethushka, by combining all who held war honors, made a final union of all the warriors in the tribe, for among the Omaha a warrior had to be a householder and not a man dependent on his relatives.

Associations in a New England Community. As a contrast to the situation among the Omaha, we will now examine the associational system found in our own more complex society, which illustrates the process by which associations are formed in all such societies. In a New England community there are several groups of associations which play an important part in

maintaining the equilibrium of the community. These associations include the fraternal societies, such as the Masons, Elks, Moose, and Odd Fellows; the societies organized around tangent relations in economic institutions, such as labor unions, professional associations, the Chamber of Commerce, the Rotary and Kiwanis Clubs; the political parties; and the religious and charitable associations. They constitute together a complex system of associations, the variations in which depend on the variations in the other institutions of the society.

Fraternal Organizations and their Auxiliaries. One of the most striking characteristics of American associational life is the development of fraternal organizations and their auxiliaries, both of which are characterized by the elaborate rituals in terms of which the interactions of the members are regulated. These organizations must not be regarded as a single type or class of association, since they differ widely in many other respects. Their interest to us here lies in the fact that we can use them as convenient examples to show how differences in the frequencies of sets in the family may be carried over into other institutions.

The most important of the family sets which can be carried over in this way are the male and female sets, in which, as we have seen, males and females originate in set events to one another. Auxiliary organizations are formed through the agency of these sets, as follows. First a men's organization is formed, and this produces marked modifications in the family systems of the members. Much of the men's interaction takes place inside the fraternal organization, and this decreases the amount of interaction between men and women in most of the members' families. In these families, the women whose husbands or sons belong to the same fraternal organization are thus tangent to one another through this association. These women tend to form an association of their own, i.e., an auxiliary, and the increase of interaction within this association serves to stabilize the interaction rates of the women.

Two points concerning the formation of auxiliaries in New England communities are particularly interesting. The first is that they are a rather recent development, and the second is that they are made up pre-eminently of middle-aged women. These two factors are derived from the changes in the family system which have been going on in our civilization as the result of its adjustment to new economic institutions, as we shall explain shortly.

In the first place, auxiliary members are usually either single or childless women or the mothers of grown children. In other words, the women who take active parts in these organizations are those who are not engaged

in the ordinary activities of life, notably the care of children. In the case of a woman with children who have grown up and gone away, the marked reduction of the interaction with her children in the parental set has disturbed her habitual equilibrium. Such a woman is faced with two alternative avenues of compensation in her relations: (1) her husband, and (2) existing tangent relations. The auxiliary stabilizes her equilibrium in both of these directions.

Organizations which consist of a fraternal association and its auxiliary involve a habitual interaction of males and females in set events. These utilize various techniques borrowed from the family. For example, members of the auxiliary will prepare meals for joint meetings of the two associations, and at these meetings contests between the men and the women are commonly held, to see how well the men can perform female tasks and vice versa. By using such techniques to build up origins of action between members of the two associations, the members of each increase their interaction within their own organization. In the system of regular meetings, held separately, in which a regular order of events is followed, the equilibrium of each organization is further stabilized both internally and in respect to its linked organization, and thus the rates of interaction within each of them and between the pair become constant.

The Development of Female Organizations. The rather recent development of these auxiliary organizations seems to result from the changes in family equilibrium which have been widespread in the United States, and are due to the following two factors: (1) the reduction in the interaction required in the performance of family techniques through the introduction of labor-saving devices, such as vacuum cleaners and washing machines; (2) greater opportunities for individuals to become members of economic institutions outside their own communities, due to the increased facilities for transportation and communication. Also, of course, the opportunities for employment in the home community have decreased, since improved systems of transportation and communication not only create a greater mobility in occupation but also the concentration of economic institutions in large units in specialized areas. In the old days, people almost always worked within their communities, and, therefore, when a man married there was not such a sharp break in his interaction with his parents as now when he works elsewhere. This continuity of residence made it possible for the family system to readjust itself after the disturbances in equilibrium resulting from marriages without too much compensatory interaction in tangent relations.

During the last forty years, the development of these auxiliary organi-

zations has followed a very interesting sequence. They began to be prominent among families whose members were employed in the lowest class in economic institutions. In these families children went to work at an earlier age than those in any other group, they married earlier, and were more often employed outside their native communities. This situation was followed within two decades by the development of auxiliaries among families in the lower ranks of the supervisory hierarchies in economic institutions, and among people who were the heads of very small retail institutions. This developed during the period in New England when the local ownership of economic institutions began to go out with the merging of corporations which lasted until 1929. Finally, at about this time, members of higher management groups and the professional men in such organizations as the Rotary Clubs were also affected by the changing economic system, and their wives found their relations similarly changing.

The men's clubs to which those individuals in the highest brackets, financially, in hierarchical positions, etc., habitually belong have not, however, developed auxiliaries. Their wives and daughters belonged to women's clubs long before the auxiliary movement started. Since these women usually employed servants in their houses, the changes in modern conveniences made little difference to them, and their children were usually taken care of by nursemaids in the afternoons. When they reached their middle teens the children were usually sent off to boarding school, and thereafter their visits to their parents' homes were usually sporadic and of short duration. Hence there were no sudden changes in the interaction rates of these women, but they had time to interact outside the family both before and after marriage, and furthermore, and this is of considerable importance, they had many kinds of tangent relations with women other than those they knew through their husbands. Hence there was no need for their women's clubs to be linked to male organizations. Furthermore, they participated in many of the same activities as the men, particularly in sports, and for this reason belonged to many mixed associations.

Mixed Associations. Mixed associations, to which men and women both belong, are not the exclusive property of the so-called leisure class, but may be formed wherever men and women interact frequently together. Besides the higher-bracket clubs, in which there is usually little formality, there are other mixed associations in which the interaction is conducted with much ritual, notably fraternities and their auxiliaries. The most important of these is the Grange (the Patrons of Husbandry), an association in which families having a similar state of equilibrium are united through tangent relations to other institutions.

The relationship between man and wife in a farming family is necessarily different in interaction from that of urban dwellers. In the type of family that produces the auxiliary system, the man ordinarily is away from his home at his job during the greater portion of the day, and except when he is not working he sees his wife and children only in the early morning and evening. The daily routine of existence in such a family does not involve many techniques in which husband and wife interact. In a farming family on the other hand, although the man may be working in the fields a large part of the day, there is a much greater amount of family interaction, particularly in the winter. Moreover, the children very soon begin to work on the farm under the direction of their parents, and though there is a decrease in the interaction rates as the children become independent, the resulting family system shows different lines of cleavage from those found in the city. In these families, the man and wife are not separated and the line of change in interaction rates comes between parents and children rather than between mothers and children only.

Charitable Associations. One other important variety of association is characteristic of a New England community; this is the charitable type of organization, which includes Societies for the Relief of Aged Men and Women, the Community Welfare Association, the Red Cross, Societies for the Prevention of Cruelty to Children or Animals, the Hospital Aid Associations, Library Association, the Anti-Tuberculosis Leagues, etc. These organizations are based upon the origins of action made by individuals within the association to individuals or groups outside it. They serve to stabilize the equilibrium between the two classes in the set thus formed. Indigent families are helped by gifts of food, clothing and money, and members of the interested association make frequent visits to see how the family system of the beneficiary is operating. In this way, many of the activities of a Mumi or a political leader are taken over by associations, which develop as specialized institutions whose members are able to maintain their origins of action in the society as a whole. The recipients of favors in this type of institution form a fluctuating Class C, comparable to the enemy in a military organization and the customers in a trading institution. In many cases these associations have highly developed hierarchies both within each local district, and by combining communities into county, state and national institutions. Their importance, however, lies in the fact that there is a continual series of origins going from members of the association to those whom they help, and in general this system of associations originate action to special groups of people in much the same way that various departments in the political organization do. These associations are built up

in much the same way as the doctoring societies among the Omaha, that is, they represent the development of tangent relations between people who originate to a common class of terminators. As a result of this process by which some individuals develop a clientele among the poor, the ailing or the sick, a number of specialized associations of this type develop. They are based upon all the crises in the relations of individuals where disequilibrium develops.

IV. ASSOCIATIONS AND THE MAINTENANCE OF EQUILIBRIUM IN COMPLEX SOCIETIES

In every society where associations are found, they provide us with an excellent way of locating the lines of cleavage which mark the areas of instability in institutions. The proliferation of tangent relations and their extension in associations are important factors in maintaining the equilibrium of a complex society. In the next chapter we shall discuss in detail how the interrelationships of institutions make up a total system in equilibrium. We shall see there how, just as in the case of individual institutions, the combination of institutions that makes up a society is also in a state of equilibrium. However, it may not be amiss, now that we have described the associational systems of the Omaha and of a New England community, to mention the part that associations play in the totality of human relations in relatively complex societies.

Every individual living in a complex society will ordinarily belong to one or more associations, and his equilibrium, therefore, consists of his adjustment in family, economic, political and religious institutions, and in the associations, themselves institutions, which stabilize the relationships of these various systems. In the process of adjustment, an individual may join a number of associations, and in some of these he will find that he is able to build up satisfactory relations with other individuals. In others, in which the interaction does not help to balance his system of relations, his maladjustments may be accentuated, and if he is to restore his balance, he must drop out of these associations.

As times goes on, every individual undergoes changes in his relations as the individuals with whom he interacts change under the effect of crises. Individuals and institutions are, therefore, continually in a state of mild disturbance and readjustment, and in this process the part played by a particular institution in an individual's life changes also. In the other institutions, family, economic, political and religious, people die, move away, and change their position in the hierarchy. In response to these alterations, people join new associations and drop out of old ones, become active or in-

active in them. In many societies the process of adjustment in associational institutions goes on continuously. Just as other institutions are, as we have seen, subject to the formation of new sub-systems and the growth of departments and divisions, so with associations the same process goes on. Some of the large associations break up into small ones, sub-systems form within others, like the 40 and 8 of the American Legion, and a continual process of splitting up and regrouping into larger associations is in progress. The rate at which these adjustments take place indicates the degree of stability of the society as a whole, and the number of associations in it is a measure of its complexity, since no associations at all are found in simple societies, and the number of them increases as the number of other institutions in which individuals interact increases.

V. CASTES AND CLASSES: HIERARCHICAL DIVISIONS CROSS-CUTTING INSTITUTIONS

A further development on the basis of tangent relations in many complex societies of the world is the so-called class system in which all the members of a class irrespective of the institutions to which they belong originate to members of another class who terminate regularly to them. All through Europe in the Middle Ages the three classes, nobles, commoners, and serfs, could be easily distinguished by their habitual behavior to one another. These classes were roughly based on lines of fissure in habitual rates of interaction comparable to the "work line" mentioned in the development of unions. In most European countries, such classes continue to the present day. In England, for example, although there is a representative type of government, the continued presence of these classes has prevented the development of a completely democratic system. This was the case in the United States one hundred and fifty years ago. Some of the Founding Fathers had grave doubts about allowing the common people the franchise and wished to restrict political control to "gentlemen." Class distinctions have steadily disappeared, contrary to the beliefs of some authors, since that time. In a few places, the language of class is still in use, but the small groups of people still holding to it are unable to get responses from those they consider their inferiors, except within specific institutional frameworks.

Probably the most complexly differentiated societies in the world are those of the so-called caste system which is found in India and also in parts of Africa, such as the western Sudan. In India, which is the classic home of the caste system, there is, according to popular belief, a continuously graded series of endogamous groups each of which practices a single occupation. These castes are supposed to have become differentiated as a result

of the Aryan invasions and the repugnance of the conquerors at mingling with their inferiors. Just how much this theory amounts to, and how it can be supplanted by a more rational explanation, may be determined by a study of the situation in the state of Cochin in southern India.[3]

In Cochin, the people are divided into groups of so-called "castes," each of which is endogamous, and is subject to the leadership of a council of head men who administer its affairs. Each of these castes, therefore, is an endogamous kinship group which is similar in structure to some of the clans which we have already described in Chapter 13. So far there is nothing unusual about them. It is, however, the relations between these castes that has given rise to the speculation mentioned above.

In the first place, the interaction between members of different groups is highly formalized. In some cases all interaction is prohibited, and one group is considered to pollute the other if the members converse or touch each other. In other cases, the members of two groups may go so far as to eat together, while in still others they may even intermarry. On the basis of these distinctions in the interaction of individuals as members of groups, a series of rationalizations has been developed by which some individuals, on the strength of such criteria, claim that they are superior to others.

A systematic analysis, however, indicates that there is little correlation between the various criteria which are considered to designate caste groups. For instance, two groups who may eat together may or may not intermarry. Although, in general, groups which pollute each other do not intermarry, groups which do not intermarry may or may not pollute each other. In contradiction to the general belief, only fifty percent of these groups have a common traditional occupation.

What seems to have developed here, and in other parts of India as well, is a series of groups whose members interact with each other within their organizations in much the same manner as do the members of associations in other societies. Two factors are important in differentiating castes and associations. The first is dependent on the type of political institution; the members of all of these castes respond in set events to the origins of a ruling class. The second involves the interrelations of family and association due to the high frequency of interaction of the former; there is a tendency for the caste to become endogamous if it has been in existence for a long enough time, and thus to become a complex family system.

As numerous writers have shown, the development of caste groups in India as part of the spread of the political and religious hierarchies in that area has taken place in two principal ways. One is the absorption of the

[3] Iyer, K. Anantha Krishna, *The Cochin Tribes and Castes,* 2 vols., Madras, 1909.

organized; that is, the institutions which are found in it are made up of sets of relations in which one person originates action and others respond, and there may be several classes of individuals arranged in sets in any institution. We have already seen how extensive hierarchies develop in economic, political, and religious institutions; in such institutions men who are at the bottom of the administrative set in one organization may very likely be at the bottom of a similar set in another, and men at the head in one may be at the head in the others. As a result of this, tangent relations often develop between the individuals who are all at the bottom, and between those who are all at the top. For example, the political leader will go to the manager of a factory and ask him if he won't let his workers off ten minutes early that day to attend a political rally, while two workmen will go together to the motion pictures in the evening.

When habitual interactions of this sort develop, groups of friends, which some writers call *cliques,* tend to arise through the mechanism of tangent relations. If stress situations develop, these cliques may, as we have seen, become institutions. Cliques are non-institutional associations because they have but a single set, consisting of one or more leaders and their followers.

Membership in cliques and associations is not diagnostic of a class system. To have the latter, the members of Class A above the line must interact with a high frequency with each other, and the same must be true of the members of Class B; while the interaction between A and B must be low and A must always originate to B in set events and B only respond. A further postulate of this theory would be that membership in these classes may be clearly defined and precisely known, i.e., that each class forms a system.

The extent to which this situation obtains varies without doubt in different societies. In our own society class distinctions have been well demonstrated in the Southern states between whites and Negroes. Here there is a clearly defined set in which the whites originate to the Negroes at a high frequency and the Negroes are not allowed to originate to the whites in set events. This situation is, of course, the result of the importation of one group of people into an area by a group which was politically and economically dominant, rather than a case of the emergence of classes from a common level, as explained above. In the case of the Negro-white situation, the fact that there are very marked physical differences between these groups to serve as symbols of identity, makes it difficult for "mobility" from one to the other to take place. This may be contrasted with the situation in Greece and the Roman Empire, where slaves could not be so distinguished and in which the mobility was by contrast very great.

Aside from this relationship between whites and Negroes in the South, it would be difficult to prove the existence of social classes in the United States. One might contend that those persons whose names appear in the Social Register or in *Who's Who* formed the top rank in some such class system, or that it was made up of all those persons whose daughters belonged to the Junior League, or who sent their sons to certain schools. It is no doubt true that cliques do form on such bases, and that members of some cliques have relatively higher positions in the hierarchies of some institutions than the members of others. But no true social classes exist in a society such as ours, because a man who is a member of the Class A group in one set will belong to Classes B and C in others. A young man with what is considered the highest possible background will usually have to start at the bottom in a business office, and if he is drafted into the army he will have to begin as a private. The young men who are sent to West Point and to Annapolis to train to become officers, on the other hand, are selected from every rank in the different hierarchies of our society, and from what those who consider we have a class system would call all classes.

This does not prevent some cliques, however, from thinking that they are better than others, as we have already seen in the case of the caste system. A member of a Woman's Club may consider that the activities in which she and her fellow-members indulge are definitely superior to the activities of an organization such as the Mooseheart Legion, but she cannot originate action habitually to the members of the Mooseheart without their originating in turn. Moreover, the fact that the members of the Woman's Club may not interact with members of the other organization might equally well be considered a sign of the superiority of the other organization. The feeling of superiority is a rationalization based on the fact that in a tangent system the husband of the Woman's Club member may originate action in the administrative set to the husband of the Mooseheart member, i.e., he may be his boss, but the situation might be, and often is, exactly the reverse. No classes in the English sense exist in this country. In the words of Abraham Lincoln, "There is no permanent class of hired laborers amongst us. Twenty-five years ago, I was a hired laborer. The hired laborer of yesterday labors on his own account today and will hire others to labor for him tomorrow. Advancement—improvement in condition—is the order of things in a society of equals."

NOTE

In the preceding chapters in this part of the book we have isolated the sets making up each institution, and in certain cases we have used the same

names for sets in different institutions. It should be emphasized that the use of the same name, for example, the administrative (supervisory), or the staff-line or processing sets, does not mean that the same individuals are to be found in each set. It should have been obvious that a processing set in a religious institution, composed of priests, does not include the same persons as the processing set in a shoe factory. We have used the same names, rather, to indicate that within all these institutions there is a basic similarity in the arrangement of the sets in reference to one another. Each of these institutions was composed of a leader (often with subordinate leaders) and his followers. In the family, the special biological situation made us call this the parental set, and in the religious institution we called it the religious set. In the other cases we called it the administrative, or alternatively the supervisory, set.

Within such an arrangement of a leader and his followers in a set, other sets developed which involved different arrangements of the membership of this basic set. These were the processing sets, so-called because they involved a division of labor usually caused by technology resulting in set events among the members of the supervisory set, and a staff-line set in which other individuals originated to the groups differentiated out by this set. In the family, the male and female sets are analogous to these two sets.

Other sets include the age-grading set, the representative set found in associations, religious, political and economic (stockholders to officers) institutions, and the commercial and the external relations sets, found in all institutions.

Some sets may be regarded as diagnostic of institutions, but only in a very rough way. An association is differentiated on the basis of tangent relations, and has no special set. The parental and religious sets are fairly easy to identify, but the others present more difficulties. The chief difficulty arises not so much in the fully developed cases of complex societies, but rather in those cases in which for reasons of isolation or competition, an institution develops a number of sets ordinarily found as parts of different institutions. It then should be regarded as a complex institution, though an examination of its history will show the type of institution out of which it has developed. A family, for example, may develop an external relations set and, like the Hottentots, become a state. A religious institution, as in Tibet or in Rome during the Middle Ages, may similarly develop such a set. It, too, then becomes a state, and we speak of a theocracy. Such examples represent extreme specializations, and they also indicate why a particular set cannot be selected as an unerring diagnostic.

The only systematic way of differentiating institutions is by member-

ship in Class C of the most inclusive set in the institution, as the following table indicates. In order to determine the number of institutions in a group,

Family	*Political*	*Religious*	*Economic*	*Associations*
Includes persons of both sexes and all ages interacting in Parent-Child relationship. May be extended to include members of clans, tribes, etc. Numbers limited by nature of basic relationship.	Includes all individuals in a "group" or "state," when they habitually respond to origins of a leader or leaders.	Personnel not necessarily coterminous with group. Extremely variable, from shaman and a few clients to huge international churches.	Personnel not necessarily coterminous with group. Also very variable in numbers, from merchant and a few clients to large international companies.	Personnel drawn from other institutions through tangency of relations. Numbers also extremely variable.

start with the family and determine its membership. If there are then individuals who do not belong to a single system, is there any set of relations, such as the external relations set, in terms of which they are organized, and so on? This process of determining the membership in institutions involves seeing whether what are thought to be separate institutions actually have a set in common; if they do, they are of course the same.

Institutions cannot be distinguished from one another in terms of the frequency of interaction which goes on within them. Some associations, for example, meet but once a year, as, for example, the Harvard Class of 1925 Association, which is composed of men tangent to each other through membership in that class; other associations may meet every night, as, for example, some athletic associations. Equal variability is true in all other kinds of institutions, even families, in which members may be separated from each other for differing periods. Each individual who belongs to a number of institutions strikes his own balance of interaction between them, and this varies greatly between persons.

SUMMARY

Within any institution the adjustment of the members to one another represents a balance of their interaction rates. As crises arise these rates will be upset. In such an event there are two ways in which an individual can restore equilibrium in an institution: (1) by taking part in a Rite of Passage, and (2) by changing his rate in other institutions by way of compensation. Where a society includes but one institution, the former is the only possible outlet. But even where there are several institutions, it may happen that a person cannot make his adjustment for a disturbance in one without upsetting another; hence he can secure this adjustment only through tangent relations. People who have tangent relations to one an-

other both interact with a third person. Thus yachtsmen form a club, parents and teachers form a club because both originate to the same children, and workmen who terminate to the same bosses form a union.

People who have tangent relations with one another may form a separate system in which to interact, and by shifts of interaction rates in this system they can make their adjustments to disturbances of equilibrium in other institutions. These systems formed at the points of tangency in the relations of systems and sub-systems are called *associations*.

Associations vary greatly in complexity and in numbers of sets. They may have administrative, representative, staff-line, processing, etc., sets, depending on the basis of interaction of the association in question. The number of associations to which a person may belong is unlimited; he belongs ordinarily, however, to but one family, one state, one church, and one main economic institution. The number of associations in a society is an indication of its relative complexity.

When one association arises, another may also arise which is tangent to it; e.g., a Ladies' Auxiliary made up of women whose husbands belong to another association. This compensates for their loss of interaction through the absence of their husbands at meetings. Women who join auxiliaries in our society do so mostly when their children are grown up and the family interaction has been reduced; also the reduction of housework due to the introduction of labor-saving machinery is a factor.

Associations in which only males or females are found occur where institutions to which they are tangent are also one-sex systems, such as the army or a machine shop. When members of a family do their daily work together, as on farms, they will also belong to mixed associations. Another kind of association is the charitable association, in which the members originate to the poor, who form the point of tangency. These associations serve to maintain the equilibrium of the whole group.

Castes, as they exist in India and elsewhere, are in some instances associations of people performing the same techniques who are or come to be in tangency with the same institutions, and who then intermarry and form endogamous family systems. In other instances they are composed of members of a native tribe which has been assimilated into a larger political system as an endogamous unit.

Castes are not the same as classes. Classes exist only where members of one group of people originate to members of another in all set events in which both take part, and where members of the second group respond to the first in all cases. The position of the individual in associations is an index of general social status but does not indicate a class system.

CHAPTER 18

The Interrelationship of Institutions

THE PARTICIPATION OF INDIVIDUALS IN DIFFERENT INSTITUTIONS

In the previous chapters in which we dealt with separate institutions, we found it necessary to regard each institution, for the moment, as isolated from all others, in order to study the particular way in which the relations of which it is composed are organized. In so doing we were obliged, nevertheless, to consider how tangent systems might serve to modify its structure in each case. In the last chapter particularly, in dealing with associations, these tangent relations had to be considered at length, since it is upon tangent relations that associations are based.

The reasons for the interdependence of institutions are very simple. Institutions do not exist in a vacuum; they are made up of individuals who, in a complex society, are at the same time members of other institutions. In the United States, for example, a man begins the day by interacting with the members of his family, his wife, his children, and possibly other relatives such as his brothers and sisters, his mother or father, or his wife's parents. This interaction continues until he leaves the house after breakfast. He may work in a factory, and there he will interact in prescribed and habitual ways with the assistant foreman, the foreman, and the men working with him. As a member of the union, he may report to his shop steward about the way the foreman is making him clean his machine.

During the noon hour he may eat in a restaurant, where through his interactions with the waitress, cashier, and proprietor he becomes a member of a retail institution. He may then go to a Five and Ten Cent Store to buy something for his home, and thus he takes part in another institution. Returning to work in the afternoon, he again takes part in the factory hierarchy, and then returns to interact once again in the family system. After supper he may attend a meeting of his lodge, or, as a member of the political institution, attend a hearing of a committee of the city council on the request of the Telephone Company for permission to erect a pole in front of his house. Each person interacts in different institutions not only during

the day, but also on different days of the week. The Legion meets on one night of the week, and the Elks on another. On Sunday there is church, to which the entire family may go, responding there with the congregation to the origins of the minister.

This elaborate sequence of institutions in which a man interacts during each day is not the only complexity in his daily life: his interaction rate differs markedly in each institution, and the events in which he interacts differ in length and frequency. His visit to the Five and Ten may have involved only a single event lasting a few minutes, while his job in the factory may require him to work as a member of a team throughout the entire day. Not only do these events differ in length and frequency, but the order of action and degree of synchronization within them also differ widely. The foreman may originate action to him fairly often during the hours of work, although this rate will fluctuate considerably from day to day. In this relationship the workman will limit his actions for the most part to short replies, waiting carefully until the foreman ceases talking. When he goes down to the club in the evening, he and another member may "yarn" contentedly throughout the evening, and here he maintains a satisfactory interaction rate. Or as an officer of the club, he may harangue the members to get them to decide on the kind of entertainment which they shall provide when they are visited by the county officers.

Out of these many events, which have different quantitative properties in different institutions, an individual's equilibrium is built up, and this equilibrium represents the adjustment of the individual to these various stimuli. When a person begins to interact in a new institution, he does not leave behind him the effects of the other institutions in which he has just taken part. The organism continues to operate without regard for these boundaries; in fact, there is a definite carry-over from event to event. A man who has had a quarrel with his wife arrives at the lodge meeting in an impassioned state and compensates by haranguing the members. The salesman who has been interacting all day comes home at night and sits in his chair and reads the paper and answers his wife's summary of the day's events with barely perceptible grunts. It is of such individuals, each one oscillating in his adjustments to the varied individuals with whose interaction rates his own are more or less synchronized, that institutions are composed.

The Equilibrium of Tangent Systems. In our discussion of institutions we have shown how interactions between individuals occur in regular patterns and how these regularities may involve different frequencies and amounts of interaction. The same thing is also true of relations between in-

stitutions. We have just described how an individual might find himself in several different institutions in the course of a single day, and this kind of situation is, of course, one way in which the institutions are related to each other. But here we propose to discuss the way in which systems tangent to each other are in equilibrium, and this will involve a consideration of some of the examples we have already given.

In our analysis of economic institutions, where we saw that the utilization of techniques of manufacture in Riffian or Melanesian families was associated with the development of an economic institution involving a trader and his customers, we had to consider tangent systems. It is easy to see that there is a direct functional relationship between the frequency of events in the family and the events in the Trader-Customer system. Any change in the frequency of interaction between the members of one system produces a change in the other.

In the relation between the political system and the economic system, the same habitual sequence of interactions is found. The attendance officer in an American school system, for example, makes regular visits to factories and stores where children under sixteen years are employed, to see whether regulations in regard to the employment of minors are being observed. If any violations are detected, he reports them to the superintendent of schools and also to the State Department of Labor and Industries. Similar examples have already been discussed in dealing with the relations of other institutions, particularly in the Associations chapter, where the entire associational system was shown to have developed out of tangent systems.

How Adjustments are Made Between Institutions in a Society. If we wish to understand the systems of relations which make up a society, we must study not only the adjustments which have been developed between institutions as they appear at the moment of observation, but also the process by which these adjustments have come about and by which they work over a period of time.

Both are necessary and interdependent. The adjustments within institutions must necessarily be measured in time, since the only way in which we can tell whether or not they are in a state of equilibrium is to find out, over a given period of time, whether their interaction rates are constant, and whether they possess the property of returning to their previous state after they have been disturbed. Only by studying changes in time can we learn the amount of change that takes place in a system in equilibrium as a result of a disturbance of a given magnitude.

This will vary considerably between the institutions in a society, because the equilibrium of a society is itself a state of equilibrium between systems,

which are themselves in a state of equilibrium, and these systems are very often made up of sub-systems which have achieved an isolation and a constant adjustment within themselves. Thus when a change takes place in one institution, a series of compensatory changes takes place in other institutions tangent to it, but nevertheless these changes do not proceed with equal velocity throughout the entire system of tangent institutions.

Those institutions in a very stable state will often have considerable inertia, which means it would take a large change in the interaction rate of a tangent relation to disturb its equilibrium. This kind of situation is easily understood when you watch the progress of a strike in a factory. Under ordinary conditions, certain departments in the factory are in a stable state and the tangent systems of the individuals making them up are equally stable. Thus, owing to the organization of work and the sets of relations in the factory, wide changes in interaction which may arise in certain parts of the production system may involve no changes in staff departments, and thus some of the workmen can remain in their customary relations within the institution.

In describing changes that take place in institutions, therefore, it is convenient to deal with those parts of a system which undergo change and to disregard the parts which remain constant. In much of what follows we shall omit from consideration the presence of systems in which interaction rates remain constant, or relatively so, and concentrate our attention upon the systems and sub-systems where changes take place. Hence if we describe the way in which technological changes in economic institutions bring about profound changes in those institutions, as well as in political and family systems, we may fail to mention that, as far as we can tell, the religious system remains constant. This omission will more often be due to the fact that our sources omit the relevant information than because we desire to simplify the presentation, for it generally happens that we have to make the assumption that a system remains constant from the fact that the author failed to mention it in his account of changes.

Changes in the Adjustments of Societies. Our principal concern in studying the interrelationships of institutions within societies is, therefore, to see what changes take place as a consequence of disturbances in one or more institutions. These changes may be divided for convenience into two types: (1) Recurrent and (2) Non-recurrent. We have already considered some of these briefly in discussing the crises which disturb individuals and groups, but here it will be more convenient to outline them systematically and study a few in some detail as examples.

1. Recurrent Changes: Periodic

Recurrent changes may be subdivided into those that are periodic, or cyclical, and those that recur without any regular rhythm. With the first type, the periodic changes, we are already somewhat familiar. In the beginning of this section, in discussing the daily and weekly changes of the interactions of an individual in different institutions, we saw how these interactions were controlled by a daily rhythm. In every society these rhythms differ, and marked variations in the equilibrium of individuals arise from this fact. Let us take two examples of this: one from a simple society in which all interaction takes place within the family, and one from a more complex society.

The Andamanese. In the Andaman Islands, where people live by a simple food-gathering technology, the different family groups within a camp break up in the morning, the men going off hunting or fishing, and the women and children staying about the camp and gathering food. By midday the camp may be quite deserted, save for a few old men and women and a few children. In the afternoon, the women return from the forest with the food they have collected and the men come in with game. If a pig has been brought in, the men cook it in the public cooking place, cut it up and distribute it to members of the community, and the women then proceed to cook the family meal. Each family eats by itself. After the meal is over, the men may spend an hour or two dancing to the accompaniment of a song sung by a man with a chorus of women. They may then eat another meal when the dance is over, and after this lie down in their huts to sleep. The rhythm of this interaction is quite different from, let us say, that of the farm family in the United States, where there may be a regular routine of three meals a day with all the family present.

Just as there are daily variations in interaction in every system of relations, so are weekly changes equally common. Religious institutions characteristically hold most of their interactions one day a week. The Christian goes to church on Sunday, the Mohammedan to the mosque on Friday, and the Jew to the synagogue on Saturday. In the chapter on Economic Institutions, we saw how the markets in the Rif were held once a week in a particular district, and here as well as elsewhere the religious and economic institutions are dovetailed so that on the day of religious activity, economic institutions are not in interaction.

It should be pointed out, however, that such precise periodicities are not generally found in the very simple societies, like that of the Andamanese, the Australians, etc. In societies where calendars have been developed, gener-

ally in association with the phases of the moon or divisions of the solar year, festivals and other regular activities occur with considerable accuracy. But among the simpler groups, particularly the food-gatherers, the rhythmic variation is seasonal, and the changes in the seasons are generally based upon observation of the flowering of plants, the appearance and disappearance of certain animals, etc. Every group, of course, has seasonal variations, and the Andamanese, being about the simplest society that exists, presents us with a very clearly marked seasonal variation in interaction.

The Andamanese, as we have seen, live in a monsoon climate. During the rainy season they live in their main encampment and are chiefly concerned with hunting. At the end of the rainy season, there comes a brief period of unsettled weather, during which vegetable foods begin to be more available, and the natives also gather insect larvae and feast on them. This period is followed by a cool season, when fruits and roots are plentiful, and little hunting is done. Some of the forest-dwellers leave their camp and go off and pay visits to their friends in other groups; those who remain live in temporary camps. Instead of the men going off by themselves, they help the women to look for fruits. When the hot season begins, honey becomes plentiful and everyone is busy collecting it. Pig-hunting is abandoned because the meat is in poor condition. At the end of the hot season, the natives return to their headquarters camp to start the hunting season.

Thus these seasonal shifts, which are determined by changes in the technology of a people in adaptation to the environment, produce changes in the personnel of the individuals in the camp and in the frequency of their interaction. As we have seen in Part II, in reference to technology, these seasonal changes are characteristic of every society and involve systematic changes in interaction. The amount of change in interaction during different seasons depends on the balance between the amount of seasonal change in a given environment and the degree of perfection of the techniques, such as housing, transport, clothing, etc., by which they counteract it. We shall see a more elaborate example of this in the case of the Omaha.

The Omaha. The Omaha, with whom the reader should by now be familiar, were a buffalo-hunting people who also practiced some agriculture. In the spring they used to plant corn, squash, and beans in gardens along the stream near the permanent village, and men and women worked together. They kept up their agricultural activities by weeding and hoeing these gardens until the tribe started out on its annual buffalo hunt in July. When this happened, as we have seen, the hierarchical institution, headed by the hereditary Leader of the Buffalo Hunt, started to operate as a result of the changes in techniques associated with the movement of the tribe

away from its permanent winter village into a summer existence in tipis. Just before the hunt began, the Keeper of the Sacred White Buffalo Hide called a council of the Seven Peace Chiefs, and the selection of the hereditary Leader of the Buffalo Hunt was confirmed. At this council, the general direction of the hunt was decided, and from this time on the hereditary Leader was in charge.

During the march, each night the women set up the tipis, and the tribe camped in a circle called "Huthuga," with its entrance facing to the east, and each gens (patrilineal clan), sub-gens, and sub-division pitched its tents in a definite position in the circle. If a man stood in the entrance to the circle and looked toward the west, the five gentes of the earth moiety were on his left hand and the five gentes of the sky moiety on his right. Thus during the entire time of the hunt, every family had its position fixed in relation not only to the other members of its gens but also to its neighbors. For example, the members of the Washabeton, a sub-gens of the Honga gens, had on their left hand the Xuka division of the Wacabe Itazhi, a sub-gens of the Thatada. And when the members of the Honga gens sang its rituals, members of the Xuka division acted as hereditary prompters.

When the tribe reached the buffalo country, the Chiefs and the Leader of the Buffalo Hunt and the Keeper of the White Buffalo Hide met in council and appointed the soldiers. Then they held the buffalo hunt in four big tribal surrounds. Once these were over and they had all the meat they needed, hunting activities stopped and preparations began for the ceremony of the Sacred Pole.

We shall consider this ceremony in some detail in Chapter 21 from the standpoint of the Rites of Intensification. Here we wish merely to say that in it two systems of relations were active: (1) those between the men who had previously won war honors, and (2) those between the Appointive Chiefs (Nikagahi Xude), who, together with the Seven Peace Chiefs (Nikagahi Shabe), were summoned to take part in the ceremony, and who had been relieved of leadership during the actual hunting.

In one part of the ceremony, for example, the Chiefs originated action to all of the warriors (householders) by sending a message to each through the tribal herald, and they were supposed to respond by sending one of their children with a special piece of buffalo meat to the Keeper of the Pole. At the end of the ceremony, the young men of the tribe made a mock charge on the camp, and the warriors who had won honors in defensive warfare acted out their experiences. The final ceremony of the buffalo hunt season, the Hedewachi, involved all the members of the tribe, who re-

sponded in unison, organized in their gentes, in songs and dances to the origins of action of their religious leaders. At the end of the ceremony, in which everyone, young and old, took part, the members of the tribe were free to break up and either return to the village or continue to hunt in small groups.

In the sequence of ceremonies just described, the analysis of which will concern us later on, the political, religious and family organizations were all in relationship, but after the annual breakup of the tribe and its return to winter quarters, the activities associated with these institutions became much less frequent, and there was a corresponding rise in the interaction with the tribal associations, the organization with which we dealt in the last chapter. Most of the associations met about once a month throughout the winter, with the exception of the Shell Society, whose regular meetings were in May, June, August and September, before and after the annual buffalo hunt. At these meetings the members were concerned with symbolic activities associated with the principal food animals of the Omaha: the black bear, buffalo, elk and deer, all of which they hunted during the spring, summer and fall.

The Omaha, therefore, represent a group in which there is a marked alternation between a period in which the political, religious and extended family organizations are active and a period when small family groups and associations are principally active. A similar alternation is also to be found in the majority of white communities in the United States, where meetings of associations are largely held in the fall, winter and spring. Among most people who have associations these seasonal variations, therefore, which are based upon the techniques by which the people adapt themselves to their environments, provide the mechanism for an orderly shift from interaction in one institution to interaction in another. They may, therefore, be regarded as an example of similar adjustments in other societies, where the necessity of individuals to interact at an approximately constant rate requires a periodic readjustment of their participation in the institutions which exist in their society. These interactions, then, take place without too much variation for the tolerance of the system, which changes with seasonal regularity from one level of equilibrium to another.

Beside these daily, weekly, and seasonal changes in frequency of events illustrated above, in many societies where calendric systems have been developed, other cycles of activity occur at longer intervals. The Olympic games were held once in four years; the Gallas change their political officers once in eight. The Aztecs held great ceremonial festivals every twenty years, the Mayas every fifty-two, and in our own New England communi-

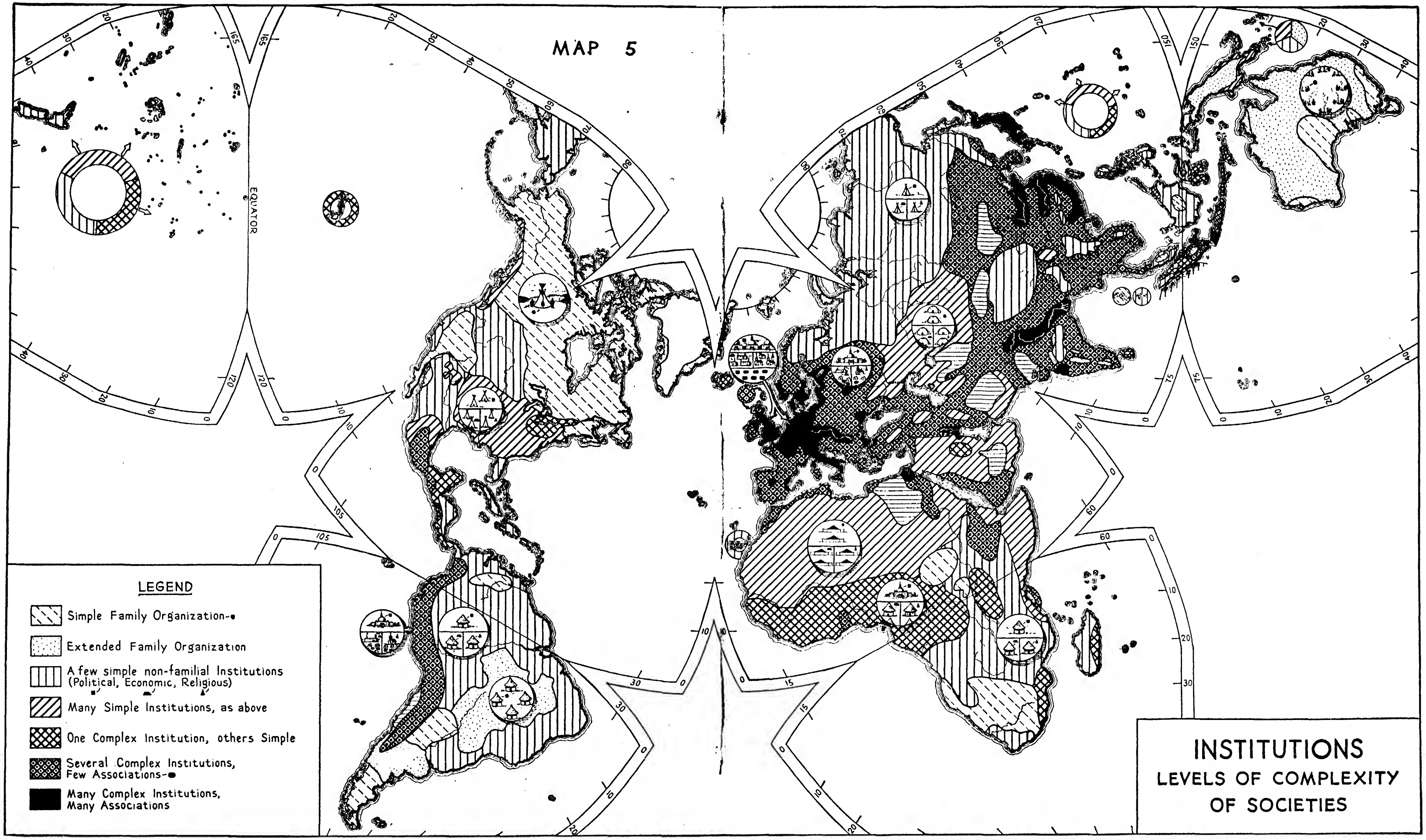
ties we have centennial and bi-centennial and even tercentenary celebrations to commemorate the founding of different communities and colleges.

Recurrent Changes: Non-Periodic. Besides these periodic changes in the interaction rates, we also find others that have no regular periodicity, but which occur frequently enough to build up habitual tangent relations between institutions, as well as habitual interactions within the institutions themselves. Situations which produce changes of this kind include the crises in the lives of individuals, such as birth, marriage, death, etc., to which we have already referred. They represent an expected but unrhythmic series of changes in the relations of individuals. In many societies, nevertheless, they are made as periodic as possible.

In some peasant communities in Europe, all marriages are supposed to be performed on the same day of the year, and those who do not marry on that day have to wait until the following year. In the central tribes of the Rif, all marriages take place in September after the harvest. Traces of a similar custom are still found in our own preference for having weddings in June. In the same way, initiations into institutions are often arranged to occur at specific dates, although in many societies this regularity breaks down. Other crises, like death and birth, cannot be so conveniently arranged.

2. Non-Recurrent Changes

The recurrent changes in societies differ widely in type, and many of them must really be included under irregularly recurring crises. Under this general heading come such events as wars, migrations due to failure of crops, invention of new techniques, and the addition or loss of individuals or groups within the community. All such events, as we shall see, may produce marked changes in the equilibrium of institutions. The only reason for classifying them in a separate category is that they fall outside the tolerance of systems. In societies like those found in the Plains, war was an expected and habitual type of activity, and though its effects might cause serious repercussions, institutions which were organized around these activities tended to maintain their equilibrium. Nevertheless, the traditional pattern of warfare was sometimes upset, as in the wars with the whites, and the results of such disturbances were to produce serious modifications in the structure of the group. Thus non-recurrent crises include not only those that disturb the equilibrium of the society, after which it is restored within the limits of its habitual interaction rates, but also those which produce major and enduring changes in the adaptations of the individuals.



In the areas designated as having family institutions only, a single house indicates a simple family, a number of camp-fires or houses an extended family. Where the appended geometrical symbols indicate that there are also non-familial institutions, an ordinary habitation, be it a tent, yurt, or thatched house, means a simple institution, while a specialized building, as a capitol, factory, or church, means a complex hierarchical institution. In the circle for northwestern Europe, the symbols in the lower segment are supposed to indicate many associations.

Among the Omaha, for example, the evidence indicates that they were more agricultural in the days before the whites knew them, and that as they moved into the Plains from a more forested environment, their buffalo hunting increased and their agriculture decreased in importance. As a result of these changes, we find that a number of ceremonial activities of the gentes which were associated with agriculture and with hunting animals other than the buffalo went out of use, and many of them were no longer remembered at the time when buffalo hunting was at its greatest importance as the source of food. From detailed analysis of the ceremonies it seems probable that many of these activities of the gentes which were no longer of importance to the entire tribe were taken over and modified by the associations which seem to have developed, as we have already pointed out, in response to the elaboration of the political hierarchy through buffalo hunting and warfare and the stresses which they set up in the clan system.

The Zulu. A number of similar changes have been recorded in other societies and the variations which take place in institutions provide us with the best way of understanding historical changes in societies. One or two of these examples are of considerable interest, not merely from the way in which institutions have depended upon one another but also the way in which historical changes come about. Recently Gluckman has analyzed the development of the Zulu nation from the point of view of changes in the equilibrium of the constituent groups in response to new environments both physical and human.

That branch of the Bantu-speaking people who later formed the Zulu nation came into South Africa at about the fifteenth century. They lived in small homesteads, each consisting of a group of patrilineal kin under the authority of the senior male. They were a cattle people, and the women did some gardening. These households were combined into lineages which ultimately came under the chief of the tribe. Up until the middle of the eighteenth century, these tribal groups were constantly migrating and were subject to a continual process of splitting, as parts of the tribe formed sub-systems [1] whose relations could not be controlled within the system by the political head. The members of different sub-systems were continually quarreling; at the same time these tribal groups were adding or losing members as people moved about looking for a chief whose rule would be more satisfactory, and this process brought about a wide variation in the numbers of each tribe.

The chief was the sole head of each system. He allocated tribal lands

[1] A sub-system is a relatively isolated part of a system, as a clan is a sub-system of a tribe in the family institution.

to his subjects, entertained his followers, and loaned cattle to those who needed them. As Gluckman points out:

During this period, the political equilibrium consisted of a number of homologous small tribes which constantly fought, often ceremonially, against one another, but did not extend the sphere of their dominion and were kept small by constant fission. Quarrels between and within tribes were part of the social system, but they led to no change in the organization of tribes or the congery of tribes.[2]

As the land gradually began to be taken up, it became more and more difficult for tribes to divide and for dissident sections to escape and be independent. The difficulties inherent in this situation were enhanced by the slash-and-burn method of farming, which necessitated a continual shifting of gardens about the country. As the population increased, therefore, tribes began to increase their conflicts and to build up stabilized relationships through conquest. Gradually some tribes developed into small kingdoms, and the increased activity of warriors resulted, in the early nineteenth century, in the rise of age-graded regiments, which later became so important in Zulu history.

Up to this time the changes in the relations of the tribes to one another, consequent upon these conflicts for pasture and garden lands, brought about an increase of origins in the administrative set from the chief to his followers. That is, an increase in the origins of action of one tribe to another were compensated for not only by attacks on the other tribe but also by increasing the internal interaction in the tribe. Since this tribal system was very largely a single hierarchical institution, the increase followed the lines of interaction already in existence. Moreover, the increased number of conflicts with other tribes required a greater number of interactions between the leader and his warriors, and this aided in increasing the set events within the system. Under these circumstances a number of chiefs arose who began to build up followings among other tribes, and thus elaborate kingdoms developed. The most famous of these chiefs was Chaka, who, with the aid of superior strategy and weapons, had, before he died, made himself master of 80,000 square miles of territory and its inhabitants.

The changes which took place within the internal organization of the Zulu at this period were not limited to the administrative hierarchy, which went from headmen, sub-chiefs, chiefs, etc., up to the king, for Chaka also built up an army of warriors who were organized in regiments and housed

[2] Gluckman, Max, *Analysis of a Social Situation in Modern Zululand,* Bantu Studies, XIV, 1940, Nos. 1 and 2, pp. 1-30, 147-174.

in military barracks. These warriors were no longer under the direction of their tribal chiefs, but were directly subject to the orders of the king. The king not only stabilized his position by organizing the warriors into a separate system which could be used to attack any rebel, but also discontinued the old system, in which he allocated the land and distributed the wealth of the kingdom. Instead he obtained labor from his subjects and built up reserves of grain and cattle which were distributed down the administrative set whenever it was necessary. When trade with the Europeans developed, all of it had to pass through the king, and he redistributed the goods to the important men of the tribe. Thus the system provided a high frequency of events down the administrative hierarchy which was maintained at a constant frequency, and although the head of the hierarchy might often be replaced by quarrels within his family, the system itself continued in equilibrium until it was conquered by the whites.

The Choctaw. A good example of how a strong disturbance from the outside can produce changes in the equilibrium of a society through changes in the interrelation of its component institutions is afforded by Eggan's study of the history of the kinship systems of the Muskhogean Indians of the Southeastern United States. From the evidence in the historical records, Eggan was able to show that within the space of a hundred years several of these tribes changed from a matrilineal type of kinship, similar to that of the Crow, to a patrilineal system. Now the degree of change was most marked in the Choctaw, about intermediate for the Creek, slight for the Cherokee, while the Chickasaw have at the present time a practically pure Crow type of kinship. A hundred years ago all these tribes had similar systems, and the question which confronted Eggan was how this sequence of changes could be correlated with changes in other institutions.

The changes were found to be due to the effect of the relations of these Indians with another group of people. As early as 1819, the Choctaw were under the influence of missionaries, and they were the first tribe from the Southeast to be removed to the Indian Territory. Once in Oklahoma they set up a new system of government and a school system, under the influence of the missionaries, teachers, and government agents, who were very active in changing their way of life. The fact that the women worked in the fields and that a father (in accordance with the matrilineal system of inheritance) failed to provide for his own children particularly worried the missionaries. They introduced new regulations in regard to land which emphasized the position of the man as head of the family; by others, they brought it about that leaders no longer represented the clan, but instead the male membership of the district, being elected by adult, male voters.

Marriage was regulated by law, and widows were entitled to a dower and children to inherit their father's estate.[8]

For our purposes this indicates a marked increase in the frequency of events in the male set and a decrease in the female set. Moreover, instead of the chief being chosen by the members of his clan, as before, he was now chosen by all the males in the district, and thus the personnel of the representative set in the political institution was changed from a familial to a geographical basis. By this same process the importance of the clan system was radically reduced.

One important result of this process on the family system was the change in interaction rate between father and child. The interaction between a father and his children increased, since he now had to educate and train them, and was responsible for their behavior, while the interaction between the children and their maternal uncle, who had formerly had this responsibility, decreased.

The Creek, whose system of relationships changed less, underwent less interference from the whites, while the Chickasaw, whose system changed hardly at all, escaped white influence in these respects almost entirely.

Conclusion. These examples, then, show how the changes in interaction between specific individuals in one or more institutions are followed by changes in the relations of others in the society. Among the Omaha the change in techniques in obtaining food seems to have brought about a decrease in the interactions of members of certain clans who supervised details of the agricultural process, and increased the frequency and complexity of the system of relations organized around hunting buffalo. Linked with this was the development of a system of associations which stabilized the uneasy relations between political and family systems consequent upon this change in technology.

Among the Zulu, the abundance of free land and the technical requirements of agriculture and cattle herding resulting in the rise of local leaders, caused fissions in tribes as parts of groups became isolated sub-systems with relatively high internal and low external frequencies of interaction. Once free land was no longer available, the tribes were forced to interact with one another, conflicts developed and intertribal relations were stabilized by war and conquest.

This resulted in a modification of the political system and a strong reinforcement of the set of relations in which the king was the only origin, i.e., in the administrative set. At the same time he stabilized his relations

[8] Eggan, F., "Historical Changes in the Choctaw Kinship System," *American Anthropologist,* Vol. 39, 1937, pp. 34-52.

with subordinate chiefs by removing them from positions in which they could originate to the warriors, and developed the regimental system instead. Thus by the time that Shaka died, the process of consolidation had been completed and the Zulu state survived him.

In the case of the Muskhogean tribes, the effect of the conquest of these people by the United States was to bring about a high frequency of origins from missionaries, teachers, and government agents. By forcing certain interactions to decrease and others to increase, the whites were able to produce modifications in the sets of relations in the family, and, in the case of the Choctaw, also to break down the clan system and build up a political system to replace it.

These examples show not only how changes in interaction rates in one institution are followed by changes in others, but also how the historical process consists of a systematic modification of the equilibrium of a group in response to disturbances of a non-periodic character which are too great to permit a return to the old level of adjustment. The source of these disturbances may be either a change in environment, a change in technology or a change in personnel. Once such a disturbance has been initiated, a sequence of adjustments takes place in the interrelated institutions, as in the examples we have just analyzed.

The Relative Complexity of Societies. But one further point needs to be brought out in dealing with the interrelationships of institutions. As we have indicated in the last few chapters, there is a definite progression in the degree of complexity of civilizations as measured by the degree of organization into institutions. At the simplest level we find people like the Bushmen and Fuegians, and the Southeastern Australians, who have no institutions at all other than the simple family and small bands of related families. Others, such as the Central Australians and the Ges of the Brazilian highlands, have an elaborate system of family organization with many parallel moieties, clans, or other divisions. In other societies, where there is a more advanced technology than among the peoples mentioned, expanded families, such as clans, tend to take over the activities of the political, economic, and religious institutions, making them family affairs; this, for example, is the case with most of the Riffians.

In more elaborate societies, in which separate institutions have emerged, there is a tendency for the elaborate family groups to disappear, since their place is taken over by the institutions in question. This is the case with our own society and with many others on the highest level of complexity. In the case of many advanced peoples, such as the Greeks of the fifth century B.C., and the modern Scotch, we have historical evidence of the break-

down of the clan system with the rise of hierarchical institutions. The same is true of the Inca.

In between the stage of elaborate clans and moieties, and that of a simple family structure with many closely interrelated and fully hierarchical institutions, are a number of intermediate levels. These levels may be designated in terms of several variables: the number of institutions aside from the family in a given culture; the extent to which these are hierarchical; the number and complexity of the associations which serve to tie the institutions together. As for the last factor, the number is extremely variable, from none, as in the case of many peasant communities, to 135 or more for a town of 12,000, as in the case of Wakefield, Massachusetts.[4]

On the basis of these variables we have designated seven stages of institutional complexity listed below, and have used them as criteria for the compilation of Map 5, pages 452-453.

1. Simple Family Organization.
2. Extended Family Organization.
3. A Few Simple Institutions (Economic, Political, Religious).
4. Many Simple Institutions (as above).
5. One Complex Hierarchical Institution, Others Simple.
6. Several Complex Institutions, with a Few Associations Only.
7. Many Complex Institutions, with Many Associations.

As the map clearly shows, the distribution of these levels of institutional complexity agrees in a large measure with the distribution of levels of complexity in the division of labor and trade, as shown on Map 4, with the different combinations of techniques, as on Map 3, and, ultimately, to a considerable extent with the types of environment, as on Map 2. The differences between levels of institutional complexity, therefore, seems to be linked with differences in techniques and in environment. This linkage is not a matter of accident, but the result of a definite functional relationship. It is brought about by the operation of the processes we have just illustrated. In other words, as we saw in the Omaha and Zulu cases, and throughout the preceding chapters, the interactions of a group of individuals are dependent upon the routine activities of existence which are furnished by technology operating in specific environments. The division of labor, for example, which we discussed in Chapter 11, represents the groundwork of the institutions. Where a specialist arises with a clientele, we already have a simple institution in the process of formation. It is small wonder then that these maps agree in major details; anyone who has had to live in the

[4] *Boston Herald,* April 29, 1941, p. 8.

jungle or on a desert or on the polar wastes knows at first hand what environment and the available technology will do in controlling the complexity of the relationships of individuals.

NOTE: ON THE DANGERS OF LABELING SOCIETIES

There has been a widespread attempt by writers of all persuasions, ever since the beginning of written history, to develop labels by which societies or peoples could be dealt with as entities. From what we have said so far it should be clear that sufficiently detailed data enables one to give a quantitative description of a society. Even if this information is not available, any thoroughly detailed study of a group should give us enough information to tell us something about its institutions, and from that certain generalities may conveniently be made, providing we always keep in mind that they are only quick, preliminary sortings.

In Tikopia, for example, almost all interaction takes place within the family, while in the United States the economic institution may well provide the greatest amount of interaction for many individuals, and many writers, preachers, and the like do not hesitate to call us a capitalistic nation, and the British a nation of shopkeepers. It is very common also to read that the Spartans were a warlike people, or that the Plains Indian society was dominated by associational life, while the Chinese are strongly familistic. By easy stages the labels begin to include other matters. The Arabs are called religious fanatics, the Hindus mystics, and the Tibetan state theocratic. Considerable truth might be shown to lie behind some of these labels, provided objective methods of description were employed, defining the meaning accurately. The trouble is, however, that most labels of this sort are based on subjective judgments which may be the result of a single happening which strongly affected the writer of the account. In some cases, in fact, these evaluations are entirely personal and represent the individual's own maladjustment which he finds reflected in the people he studies.

Even when it can be shown that a majority of the population interact in a given institution more often than in others, it does not necessarily follow that such a characterization gives an adequate account of the facts. In the first place, other institutions containing a small number of people may have frequent relations tangent to the major institutions, without which the institution in question would be in a state of disequilibrium. This sort of dependence is particularly obvious in such an example as a retail store which has to maintain relations with wholesalers and manufacturers. More-

over there are wide differences in the frequencies of the sub-systems of a given institution, and so too the economic institutions vary in the frequency and amount of their interactions.

When writers state that the family is the dominant institution in a society, or that the family system presents a particular form, they are ordinarily talking about what they would call a normal, or average, family, and generally they fail to explain how their judgments have been reached. The fact is that there are repetitive variations of family systems in every society, and, as we shall show a little later, the particular equilibrium attained for each family in a group may vary considerably. This is true not only because the personnel of families differs in the numbers of persons in interaction, but also because of the differences in interaction rates of the constituent individuals. A family of ten necessarily involves a more complex system of relations than a family of three; and a family in which the parents have a low origin rate attains a markedly different equilibrium than a family with one or both parents having a high origin rate. So when statements are made that an institution or an individual is important in a society, or that either is characterized by a particular kind of activity, we must always ask how this is defined and under what conditions it is found.

Labels like mystic or fanatic applied to the Hindus or the Arabs go a step farther. When they are actually attempts to sum up the general impressions of the field worker resulting from his observations, and not attitudes fostered by preconceived notions, they can be reduced to statements about the interaction rates within the several institutions of the people concerned. The great possibility for variation makes this an especially dangerous form of labeling. The interaction rates of any individual vary on a continuous scale, and even within a single institution there is a certain range, all degrees of which may be found. Attempts to label a people, therefore, ought to be looked at with considerable suspicion by the student, because they tend to conceal the complex adjustments in the interaction rates of the members of the institution from the users of the label. Even though the person who first attached the label may be aware of these variations, its continual use will lead many into a credulous acceptance of a uniformity not intended in the first place.

SUMMARY

In a complex society in which there are many institutions, a given individual may interact in many of them each day—in his family, his business, in stores where he makes purchases, in his political organization, his club, etc. Through these various institutions his equilibrium is attained,

and through persons like him the various institutions in the society are interrelated.

The equilibrium of a society is itself a state of equilibrium between institutions, which are themselves in equilibrium, and which in turn are made up of the equilibria of individuals. When a change takes place in one institution, a series of compensatory changes take place in other institutions tangent to it, and the latter will vary in terms of the degree of tangency and the relative inertia of the system. Changes in the equilibrium of societies may be brought about by:

(1) **Recurrent Changes.** These include such periodic changes as the alternation of night and day, and of the seasons, which are followed by associated changes in human relations—i.e., daily and seasonal cycles of activity, with their consequent changes in the equilibrium of institutions. They also include non-periodic changes which occur frequently enough to build up habitual changes in interaction rates between individuals and institutions. Under this category fall individual crises such as births, deaths, and marriages.

(2) **Non-Recurrent Changes.** These are caused by changes of climate or of environment, the invention of new techniques, the rise of great leaders who make permanent changes in institutions, and the action of tangent institutions upon a society. The changes which they cause fall outside the tolerance of systems and bring about a permanent readjustment on a new level of equilibrium. Changes of this kind are *historic* in scope; here they serve to illustrate how when a force is applied to one institution in a society, causing a change in its interaction rates, compensatory changes in tangent relations will follow. Functional relationship can only be demonstrated between systems in motion.

By computing the number of separate institutions in a society, by observing whether these are composed of simple or of elaborate hierarchies, and by tabulating the number of associations which serve to maintain the equilibrium of the other institutions, we may formulate an objective scale on which the relative complexity of societies can be measured. Known societies vary on this scale in concert with their degrees of relative complexity in techniques, division of labor, and amount of trade, and hence the relative complexity of a society is a function of its technology in terms of environment.

PART IV

Symbols and Human Relations

CHAPTER 19

The Conditioned Nature of Symbols

THE CONDITIONED RESPONSE

So far in this book we have been concerned only with the interactions of individuals, and we have avoided as far as possible any consideration of the part played by symbols in human relations. We did this because physiological evidence has demonstrated that the process of adjustment is independent of the particular type of stimulus which produces a response. In other words, we have devoted our attention to the stimulus-response situations among individuals, and we have tried to show how the quantitative properties of the reactions making up the stimulus-response situations are sufficient to describe the relations of individuals. Nevertheless, we also know from our discussion of the conditioned response in Chapter 3 that a wide variety of phenomena very often become associated with specific interactions, and in this and the following sections we shall show how a systematic understanding of symbols, whether they are words, places, objects, or natural phenomena, can be acquired by reference to the quantitative properties of interaction.

In Chapter 3, where we discussed the process of conditioning, we saw that the repetition of a given interaction situation brought about the development of a conditioned response. To illustrate this process, we gave an account of the experiments of Pavlov whereby he established the properties of conditioning. When a dog tasted meat, the reflex activities controlled by the autonomic nervous system set up a series of modifications in the organism, the first of which was the secretion of saliva in response to the chemical-mechanical stimuli of the receptor organs in the mouth. After such a sequence had been established, it was found that the sight of meat, that is, the excitation of the visual function, which immediately preceded the taste of meat, was a repetitive and stable part of the context. A linkage was thus built up in the cortex of the brain between excitation of the visual function and excitation of a tasting function, to put a complex physiological process very crudely. In further experiments it was found that by a series of repetitions analogous to the process just described some other object could be

linked to the context and become the stimulus which would set the conditioned response in motion. By a wide number of experiments involving practically every kind of stimulus that an ingenious investigator could think of, animals have been conditioned to respond to stimuli involving many sensory combinations. For our purpose, we shall define any aspect of natural phenomena which becomes linked with basic conditioned responses, such as sight of meat = salivation, as symbols, and we shall say that symbols refer to the physiological event in question. Moreover, as we have already done, following the terminology of Ogden and Richards, and of Malinowski,[1] we shall apply the term "context of situation" to all the phenomena which accompany a stimulus-response situation, one or more elements of which may become the symbol for the situation.

Thus a symbol may be anything—an object, a word, a place, a condition, a natural phenomenon like lightning or the sun, or a person—which refers to the relations between persons, or between persons and objects, or a combination of such relations. A context of situation may be compared to the stage properties in which an act of the drama takes place.

Symbols and Interaction. In Chapter 3 we gave a few examples of the way in which symbols became segregated out of a diffuse context by repetition, and in this chapter we shall have occasion to deal with a number of other instances. It is sufficient here, however, to point out that *in most cases symbols are directly associated with interaction* in the context of situation rather than with specific objects or persons. That is, the words, objects, and other phenomena associated with an event between people become the symbols which refer to that event or to a series of events between people. In other words, a symbol which refers to a loved one refers to the effect of the loved one on the person in question in interaction.

A religious symbol refers to the relations between the members of a church, or between a shaman and his clients, and an agricultural symbol to the interaction between the persons who are concerned with the technique in question. In Australia, a totem spot, which may be a pile of rocks or a spring, refers to the relations of the people who together derive their living from that neighborhood.

The sound of a rattlesnake's tail is not, of course, ordinarily a symbol of human interaction, but of the interaction between a man and an animal. Many instances of this kind could be listed. Even when symbolized, inani-

[1] Ogden, C. K., and Richards, I. A., *The Meaning of Meaning*, New York, 1927; Malinowski, B., *The Problem of Meaning in Primitive Languages, op. cit.*, Supplement I.

mate objects, refer to interaction between individuals in which these objects form a part of the context.

If we are to understand the significance, or meaning, of symbols in our own society, or in other societies which have simpler institutions, we must first determine whether or not the explanation of most symbols is in fact, as we have stated, to be found in the interactions of individuals, and whether or not changes in the significance of symbols, as described by informants, can be shown to be the result of changes in the interaction rates and in the equilibrium of individuals in groups which we have already described in previous chapters.

In Part II, we made a systematic analysis of the techniques which people use in adapting themselves to their environments. We saw that many of these techniques imposed interaction between individuals using them, as for example, two men managing a canoe, a group of hunters surrounding a herd of buffalo, and many of the manufacturing techniques which could not be completed without the work of more than one individual. Moreover, we also saw how many other techniques which did not directly involve interaction were indirectly associated with it. Thus a single individual might make war arrows, but war parties were composed of groups of individuals in interaction, and this interaction was, therefore, in a sense dependent upon a technique of manufacture which happened to require the efforts of one man working alone. Since the manufacture and use of objects is continually associated with interaction, we should expect to find that a large proportion of the symbols used in societies referred to these situations, and, in fact, this is exactly what we do find.

A simple example will make this clear. Among the Andaman Islanders, hibiscus fiber is used for making the rope with which turtle nets are made, and which also serves for the lines of turtle harpoons and for hawsers to attach a canoe either to a stone serving as an anchor or to a tree. No other fiber is used for these purposes. Therefore, in a series of contexts of situation in which the Andaman Islanders are hunting the turtle, with a number of men paddling canoes in pursuit of one of these animals, the complex series of interactions which take place during the turtle hunt and which involve the interaction of three or four men paddling a canoe, and sometimes the combined efforts of two canoes, is associated with the use of hibiscus fiber, since hibiscus rope is a constant element in these interactions. It is, therefore, not surprising, as Radcliffe-Brown has pointed out, that in the initiation ceremony in which the initiate begins, after a long period of abstention, to eat turtle meat once again, he is surrounded with hibiscus leaves. When he starts to eat, he cannot use his fingers but has to use a

skewer of hibiscus wood. Moreover, hibiscus fiber is used in an amulet to protect a man from the dangers of the sea. Thus even when a man is not fishing for turtle, the presence of the hibiscus fiber in the amulet symbolizes all the previous events in which the individual has taken part in his canoe on the sea. Each repetition of the activities which provide the basic stimulus-response situations with which we are concerned involves the presence of other elements in the context, of which the hibiscus is the most constant and hence the principal one.

In the same way, other objects characteristically become symbols of work situations. The Mason's trowel and apron are symbols of the technical operation performed by a mason, his interaction with other masons, and with his apprentices, as well as his relations with the persons for whom he builds the house. Similarly, other kinds of interaction between individuals become symbolized by various objects, particularly when they are associated with set events in the supervisory set in various institutions. In this country, for example, a policeman's badge and whistle are continually associated with events in which the officer originates action to the ordinary citizen. In the Plains, the whip carried by the soldiers in the surround, which they used to keep the hunters in formation, symbolized the relation of the soldier to those to whom he originated action. And in the same way regalia becomes specialized, and officers of institutions have special symbols which indicate their position in the various hierarchies. Such a system is, of course, most completely worked out in the army and in the church, where it is possible for those conditioned in the institutions to respond instantly upon sight of the distinguishing uniform or costume, even though they may not have previously been in interaction with the particular individual in question.

The Process of Emblemization. The selection of a particular symbol is, of course, the result of its repetition in the context, but when several objects appear regularly, one may become the principal symbol and be more frequently distinguished than others. This arises from the fact that we are able to perceive, that is, to respond to, certain sense stimuli more quickly than others, and these become the ones chosen by what is almost an automatic process. A motorist, for example, after one or two repetitions, becomes conditioned to stop at the sound of a particular kind of whistle. He fails to respond to whistles which have a different sound from the policeman's. Once such a conditioned response has been built up, he may find that on some occasions the sound of the whistle and his own response in stopping the automobile are not followed by the appearance of a policeman to discuss the character of his driving; rather he may discover that the whistle

has been blown by a small boy and, therefore, the expected interaction to which he has been conditioned is not completed. If this happens several times, his automatic response to the policeman's whistle becomes broken down; in physiological terms, it becomes extinguished, and the next time he hears a whistle of this kind he looks for some other symbol associated with the context of his relation with the policeman, such as the uniform or the official cap, before the response takes place. Gradually by such a process the individual develops a complex pattern of symbolic situations in which he responds. Instead of responding to very simple linkages, his behavior is regulated by the necessary appearance of a group or configuration of symbols. He learns to discriminate rather than to react automatically.

The process by which an object becomes a symbol involves not only repetition, as we have said, but also the selection of the most easily distinguished properties of the object. It is for this reason that bright colors of opposing hues are habitual symbols rather than a range within one hue. Red, green, and black often have symbolic significance, but we rarely find situations in which different shades of red become of symbolic importance. This process whereby distinctive features of an object having symbolic significance become selected is technically known as "emblemization," and it represents a kind of subsidiary conditioning which is entirely dependent upon the repetition of the basic symbolic situation. Thus white animals, such as the white elephant or the white buffalo, are sacred. Albinism occurs with a moderate degree of frequency, particularly among domestic animals, but the frequency is, of course, low in comparison to the color patterns of ordinary animals of the species. Where animals, as we shall see, symbolize particular relations or combinations of relations between people, the odd or unusual one is used as the symbol of the others.

Levels of Abstraction in Symbols. It can easily be seen that symbols may be of various degrees of complexity, and thus the analysis of the meaning of symbols is dependent upon a preliminary analysis of the complexity of the interactions. This complexity can be conveniently regarded as representing a number of orders of emblemization, and the choice of symbols to a large degree depends upon this process. When we talked about the dog's behavior with the meat, the reflex pattern upon which all further conditioning was based was the process of tasting the meat, which brought about the stimulation of the salivary glands through the nervous system. When the sight of meat produces the response, it is emblemization of the first order: that is, it is part of the context of situation which the organism distinguishes, i.e., abstracts. If a simple context like the presentation of meat to a dog is enlarged by sounding a bell, the association of the sound of the

bell with the sight of meat is a second-order emblemization, and it is possible to make further abstractions as the conditioning process continues, whereby the dog responds not to the sound of any bell but to a bell sounding the note of A sharp in the middle octave, which would be a third-order emblemization, and beyond that a fourth-order emblemization would have the dog respond only to an A sharp which is sustained precisely for four seconds.

Levels of Complexity in Referents of Symbols. Just as there may be different orders of emblemization in the symbols referring to a given event, so there are different orders, or levels, of complexity in the things to which the symbols refer. In the previous instance, although the process of emblemization became more and more precise, the basic situation to which it referred remained constant. A sharp held for four seconds followed by salivation was based, therefore, upon a single reflex situation. On the other hand, when we deal with levels of complexity, a single symbol may refer to a complex system of relations.

One of the best ways to see this is to try to determine what the referent (that to which a symbol refers) of the American flag is to an ordinary individual in our society. The child's initial experience with the flag before he goes to school may lead him to associate it with parades, for as the color-bearers march past, he sees the spectators salute or take off their hats, and his father may teach him to do so. When he goes to school, he learns to respond every day with his classmates to the leadership of the teacher in repeating the oath of allegiance and salute to the flag. As he grows older, he finds that more and more institutions in which he interacts have some events in which the flag is part of the context of situation. Chief of this is, of course, the political institution, as the flag symbolizes the federal government.

Thus by a gradual process of conditioning, a single symbol—the flag—becomes associated with a complex set of institutions, and in specific contexts it may refer to any of these. Thus we can begin by saying that the first referent of the flag to the child, if he goes to a parade, is his interaction with his father and their joint response to the actions of the paraders in which the flag is included in the series of contexts of situation. Then, when he goes to school, the flag becomes one of the symbols associated with the teacher-pupil relation, and hence it refers to his interactions in the school system. As he grows older, he interacts in other institutions, like the Boy Scouts, where the flag plays an important part in the context of situations; and thus at every stage of complexity the same symbol may be found. We

can, therefore, recognize that the referents of a symbol may be grouped into progressive orders of complexity.

Since these referents are the interactions of individuals, the classification of the levels of complexity is a classification of relations and systems. A symbol may refer to an event between two persons, an habitual relationship between them, or the interactions of the individual and other members of a sub-system, system, or combination of systems. Each of these referents represents a progressively higher order of complexity, with the single event representing the first order, the relation between two persons the second order, and the sub-system relationship the third, etc. If we follow this interpretation, we shall find that much of the apparently aimless associations of symbols is due to the complexity of this process of reference. But this process cannot be thought of without regard to the character of the interaction which takes place within them, which endows these symbols with what we ordinarily call "their emotional significance."

The Emotional Significance of Symbols. As we have already seen in Part I, emotional experiences are part of the physiological processes of the individual in interaction. As the interaction rates of the individual are complex, so their effects in modifying his responses are equally elaborate. As we have seen, these responses are derived from the quantitative character of the interaction. Every individual has an habitual rate of interaction which varies systematically in response to the interaction rates of others. He may synchronize very well or he may experience a marked lack of adjustment. These degrees of synchronization and their effects upon the individual either bring about in him a state of equilibrium or else disturb his existing state.

The frequency with which events occur, and the length of time they last, each representing some degree of synchronization, condition the individual not only in his adjustments and maladjustments but also in the symbols which he uses to refer to these situations. For the individual, the symbol refers to his physiological state in interaction, and he may often give some account of these physiological changes which are associated with interaction. He refers to relations between himself and others not merely in terms of relationships in combinations of sets in systems, but also in terms of the effects which he experiences as a result of his interaction. Thus, if he is continually disturbed by the origins of action of a supervisor, the objects, words or other aspects of the context of situation in which these unpleasant events take place become the symbols of the disagreeable relationship, and the symbol itself will produce a response under certain conditions. For example, if the person who annoys him has a habit of using an expression such as "confidentially" in most of his conversation, anyone else who uses

this frequently will tend to annoy him also. A man who was cheated by his partner in a poultry business may lose his taste for chicken, since it reminds him of his experience. Symbols, therefore, produce emotion; they push the button, so to speak, that releases an emotional response.

The Need of Reinforcing Symbols. Despite its power of evoking responses, a symbol does not operate in a vacuum, but is subject to its place in the interaction. A symbol produces its result not merely by itself, but because it is reinforced by the repetitive actions of persons. Thus we find that when two individuals who live near each other interact habitually at a high frequency, and then one of them moves away, the intensity of their relationship decreases, even though they may write to one another at regular intervals. Just as the dog loses his capacity to salivate at the sound of a bell if the conditioned response is not reinforced by receiving meat at regular intervals, so two people will progressively change their relationship if they do not regularly interact at their habitual rate, and coincidentally the symbols will begin to lose their emotional significance. This happens not merely because they are no longer conditioned to one another's presence, which, as we saw earlier, is a complex pattern of interaction, but also because of their need to readjust their relations in order to compensate for the interaction which they formerly obtained from each other, and thus maintain their equilibrium. That is why, as we shall see later, the basis of all ceremonies is the regular performance of specific interactions which are associated with the symbols derived from their context of situation, and this performance reinforces the strength of the conditioned responses.

How Symbols May Change Their Meaning. Symbols do not always remain constant, any more than the patterns of interaction to which they refer are immutable. In fact, the symbol itself tends to change in concert with the changing character of its referent. Eggan has shown, in his research on the Choctaw kinship system referred to in the last chapter, that not only the behavior patterns of the Choctaw family but also its kinship terminology changed in response to the activities of the white men. He takes pains to emphasize that in each case it was the term which changed in response to the change in behavior and that it was developed out of the new relations.

In many cases, a symbol will change its technical reference, while the type of action or interaction to which it refers remains the same. For example, the word "bless" in pre-Christian, Saxon times meant "to sprinkle blood on," and referred to a ritual in which a heathen priest sprinkled sacrificial blood on his congregation. Its present meaning has nothing to do with blood, and few people are aware of its original significance. The reason

why this word has been retained is that its true referent is not blood but the kind of interaction which is found when the priest, pagan or Christian, originates to his clients.

In early Scandinavia, a hammer, particularly a stone hammer, was a symbol of warfare, because it was used as a weapon. The god Thor, who was the thunder god and the symbol of stormy weather, was believed to throw hammers about whenever it thundered, and when lightning struck it was a hammer striking. Stone hammers, long after they passed out of use with the advent of metal, were thought to be thunderbolts. Now to the men who worshiped Thor as their special god, the hammer became his symbol, and even after the advent of Christianity the members of special crafts which depended on the weather continued to use it.

At Whitby, on the North Sea coast of Yorkshire, the fishermen who go out in small boats after herring, continued, at least until a few decades ago, to wear small hammer-shaped charms around their necks as amulets. These fishermen knew nothing about stone battleaxes, or thunderbolts, or Thor; to them the charms served as a protection against storms while they were out fishing. Thus its symbolization of the fishermen's relations to the weather in terms of their technique was carried over a period of more than a thousand years during which many things in the lives of these people had changed, but not the influence on the weather on their fishing and on their lives.

The Equivalence of Referents. It is one of the principles of the process of symbolization that when two relationships are similar, the same symbol may be used to designate both of them. This can be illustrated most easily if we picture a small system of individuals in which the symbols describing the interactions are limited and present no complexities. Such a situation is often found in the immediate family where the terminology applied to the operation of the sets differentiates the individuals in terms of their positions within the sets. Thus in the parental set, we find the two terms, "parents" and "children."

When some sets are highly developed in contrast to others, two or more individuals, who are members of the same class in a set, will be designated by the same word as a symbol for their relation to a given individual. Thus among the Omaha, a man will refer to both his father and his father's brother by a single term, which is ordinarily translated "father." Among many Australian tribes, all paternal cousins older than the speaker, as well as older brothers, will be called by one term translated as "older brother."

In our own society, we call both our father's brother and our mother's brother "uncle," while the Arabs have different words, "'amm" and "khali."

The reason for this is that in our society the frequency of the male and female sets are approximately equal, while in Arab society the male set has a much higher frequency and the relationship between a boy and his paternal uncle is quite different from that with his mother's brother. In some cases, single terms may designate members of both sexes, as with our words "parent," "child," and "cousin." In this case it is due to equivalence of the male and female sets, as stated before. In some of the South African tribes a single symbol may be interchanged from one sex to another, for the evidence given by Radcliffe-Brown[2] shows that in these tribes the interaction rate and the order of actions between a man and his mother are approximately the same as with his mother's brother, and for this reason the name for the mother's brother is the equivalent of "male mother."

From this, and particularly from Eggan's evidence, it may be seen that when tangent systems do not produce too many changes in the family structure, the analysis of the terminology is often a good way to construct a hypothesis as to the way that the family system of a people operates, although this should never be accepted without confirmation from direct observation of behavior. One should avoid the attitude that many writers have taken that terminology is responsible for the behavior rather than vice versa.

The principle of the equivalence of symbols is not limited to the terminology of the family; it is equally applicable to other institutions. For example, a relationship in a set in one system may have approximately the same quantitative characteristics as a relationship in another set in another system, and the same word used in the first system may be taken over and used in the second. For example, in many patriarchal societies, the word "father" is applied to the head of the political system, as it is also in a religious system to the priest. The word "captain" may be equally well used on a ship and in the army. After the Dutch settlement of South Africa, the Hottentots took it over to designate their tribal chieftains.

In the Andaman Islands, Radcliffe-Brown has shown[3] how the word "ot-kimil" (literally, "hot") has come to symbolize a number of situations which involve many different individuals in a community, all of whom are undergoing certain characteristic changes in their relations to one another. The term "ot-kimil" is used to describe the state of an individual who is ill, or who is passing through his initiation rites, the state of individuals in a community during a typhoon period, the condition of individuals after

[2] Radcliffe-Brown, A., "The Mother's Brother in South Africa," *South African Journal of Science,* Vol. 21, 1924.

[3] Brown, A. R., *The Andaman Islanders,* Cambridge, 1922, pp. 266, 307.

eating certain foods, and the state of persons who have lost a relative. It is also used to designate a person who has just joined in a dance.

Each of these situations has in common the fact that it represents a change in the interaction rates of the individuals. In the initiation ceremonies, the youth who has been forbidden to eat any of the important foods of the Andamanese is, as Radcliffe-Brown points out, unable to take part in the activities of the group when a pig or turtle is being consumed, therefore he is unable to interact with the other individuals during these meals, which are periods of great enthusiasm and excitement.

During the period of heavy storms, life in an Andamanese village is distinctly hazardous. The high winds and lightning send a veritable shower of branches and falling trees upon the Andamanese, whose only refuge is often to wade into the water and stand there until the storm is over. During such a period, the whole ordinary routine of existence is upset. The state of individuals after a crisis such as a death, or being lost in a forest, is also an obvious disturbance of the habitual relations of an individual. The only case which is not quite so dramatic is the state of "ot-kimil" derived from eating certain foods. Here, however, there is an equally clear if less obvious change in the interaction rate. Hunting the pig or the turtle involves long sustained interactions of a group of men. When they eat the food and dance in the evening, they are interacting no longer with men only but with the members of their family, women and children. Moreover, this interaction during the feast and dance takes place at a high rate, and changes, therefore, markedly.

It is important to note that the Andamanese do not consider themselves to be in a state of "ot-kimil" after eating all foods; it is only those which involve the sustained interaction of the men in a cooperative technique that are held responsible for this condition. Thus when the Andaman Islander says that he is in a state of "ot-kimil," he is referring to a condition of changed interaction rates, which he experiences subjectively in the heightened activity of his autonomic nervous system, and which brings about a specific emotional state. When he tells the investigator about this condition, his description of the similarity in his feelings on different occasions, that is, in the physiological events of which he is aware, and also his statement as to the precise events in which he experiences these feelings, indicate that these changes are brought about by the similar disturbances in his interaction rate, and thus the equivalence in disturbance, i.e., in referents, is symbolically represented by the use of a single symbol.

The Equivalence of Symbols. In every society we find this kind of classification in use, with situations having a similar emotional content being given

a common symbol. In most societies there is some general term to indicate that an individual is undergoing a crisis comparable to "ot-kimil." However, when two relationships are equivalent in their interaction rates, although a single word may refer to the condition in question, we may also find a number of derived symbols linked to them which are considered to be equivalent to each other and which may be used interchangeably. For example, among the Omaha, the two most important foods, that is, those which are obtained by the most complex interaction, under the control of the political set, are corn and buffalo meat, and these two, therefore, are equivalent in the part they play as symbols in ceremonials. For example, the main dish at the sacred feast which precedes the annual buffalo hunt consists either of dried buffalo meat or of maize. In their mythology, their ancestors are said to have first obtained maize through the intervention of the buffalo, even though it seems probable that the Omaha cultivated corn before they hunted the buffalo intensively. Thus the myth was probably modified during late historic times to fit the changing technology of these people.

Not only may symbols become equivalent in this way—representing an object associated with a similar system of relations—but also one symbol may have associated with it a number of dependent symbols. The buffalo, for example, provides the Omaha with a whole collection of symbols derived from it. Among the tabus of certain Omaha clans are the tongue and head of the buffalo; the tezhu, which is the cut of meat offered to the Sacred Pole by each household; the tongues of the buffalo used in the sacred feast; the horn of the buffalo; its tail, and its foetus. In a later chapter we shall see how this segmentation came about.

The Antagonism of Symbols. Just as some symbols may be linked together owing to the similarity of the interaction rates of their referents, so others may be considered antagonistic, for the opposite reason, and they cannot ordinarily be used together. That is, a group of people or a person cannot use two opposed symbols at the same time, or in some cases they can never use them. This happens in the case of symbols which are associated with systems which have a low interaction rate, or where one group has a high origin rate to the members of the other.

The commonest type of antagonism of this sort, and the easiest to use in illustration is that between the symbols of the two sexes. A man would not ordinarily wear earrings or a skirt in our society, since these are symbols of the opposite sex. However in the kingdom of Yemen, where the women in the country wear trousers and large sombrero hats, and the men wear skirts, long hair and fillets around their heads, a European or an

American male passing along the road excites much ridicule because he is wearing what the Yemenites consider female garments. Anywhere in Arabia or North Africa, the rotary hand quern used for grinding grain is habitually operated by women. A man will not turn it under ordinary circumstances, but if he is fleeing his enemies and his life is in danger, he may run into the nearest tent and start turning the quern in the women's side; the moment he has done this, the owner of the tent is bound to protect him, since he has symbolically placed himself in the position of a woman in the owner's family.

In Australia, where the men habitually go off hunting and on war parties together, the male and female work is sharply separated. The men and boys are strictly secluded from the women during the initiation ceremonies. Just before this, however, both the men and boys have been in interaction with their womenfolk, and so this is the time when the males build up the frequency of their interaction together. In particular, the boys who are being initiated for the first time must have their interaction rate within the male group raised to a high frequency, and that with the women reduced to zero. Hence no female symbols may be used at this time, and symbols which are exclusively male will be brought out and shown the boys as a means of increasing the frequency. These symbols are *churingas,* carved slabs of wood or stone, some of which can be twirled on strings to make mysterious noises. These latter are called "bull-roarers." These churingas represent the interactions of the male group who live in a given hunting territory with each other in terms of their country, through the agency of mythical "ancestors." By rubbing these churingas with fat and ocher, themselves symbolic substances, and by reciting tales of the mythical deeds of these ancestors, the men build up a high rate of interaction within their own age set, which, as we have seen, possesses a high emotional content. Women are not allowed to see these churingas, and in most tribes a woman who happened to see one by mistake would be killed. In other words, during a period of change in the interaction rate, especially when new members are being taken into the system, the interaction of members in tangent systems is forbidden, as is the use of symbols of these other systems, while the symbols which refer to the relations of the system in operation are used to help reinforce the interaction.

Male symbols which always refer to the systems in which men interact are selected from the techniques used in those systems. Among the Omaha, the female symbol par excellence was the burden-strap with which women carried loads, and the male symbol was the spear or the ax. In Omaha stories about men who became homosexuals, the narrative always included

a dream in which a spirit offered a man the choice of a burden-strap or a spear, and he chose the spear. When he returned home, however, he found that the spear had turned into a burden-strap.

Within the family system, the sexual act itself is often selected as the symbol for the whole familial relationship, and hence in any system to which the family may for the moment be antagonistic, sexual intercourse with anyone will be forbidden. For example, when Creek Indians went on the warpath, they had to leave their families several days before and go through a number of ceremonies to build up interaction within the system of warriors. On the expedition, they could not have intercourse with captive women or anyone else until they had returned home and gone through a second ceremony to reduce the interaction in the war party and thus change the equilibrium of the individuals back to its peacetime level. The tabu on sex simply helped to reinforce the intensity of interaction within the political system.

Among the Yurok of northern California, where there is an elaborate development of a system of exchange of ritual gifts within the political hierarchy, sexual intercourse is forbidden during the winter, which is the time of the gift making. In the same way, canoe makers in the Northwest Coast, harpoon makers in New Guinea, and special craftsmen in many places must isolate themselves from their wives and have no sexual relations of any kind until their task is finished. It is believed that the canoe will split, or the harpoon will be faulty, etc., if this rule is broken. Examples of this kind might be multiplied indefinitely.

Aside from the sex distinction, the most fundamental division of people is between the different age groups, old and young. These age groups are often designated by special symbols which are mutually antagonistic, and which may be carried over into other institutions. Thus a beard is very often a symbol of old age, and in age-graded societies where the old men habitually originate to the young men, a man does not let his beard grow out until he has attained sufficient authority, otherwise he will be subject to ridicule. This is true in some parts of Australia and Melanesia. In our own society there is a difference between the clothing of children and of adults; an adult would only wear a child's clothing if he or she were trying deliberately to be funny, i.e., to evoke an emotional response. Among the Arabs, where the age set is weak, the children wear the same kind of clothing as their elders.

Another symbol of age in many societies is the staff, or walking stick, upon which old men lean and others cannot ordinarily use. The ancient Egyptian hieroglyphic determinant for old age was, in fact, a man leaning

on a staff. Now if a staff indicates old age and old age means authority, anyone in authority may take over the staff as a symbol of office. This is precisely what happened in early Greece, where the king's scepter was exactly this, at least during Homeric times when the word *scepter* still literally meant *the thing one leans on*. In council meetings the king's herald would hand a staff to whomever "held the floor" in a discussion, and no one could speak (originate in set events) unless he was holding it. In the famous passage in the Iliad where the Spartan Thersites spoke out of turn, Menelaus reached over and hit him with his scepter, which thus became the agent as well as the symbol of authority.

Turning to symbols which are not associated with either sex or age, we find that the Eskimo, for example, will not make a garment which has both caribou and sea-mammal skin in it, nor will they drag a seal across caribou tracks. The sea-mammals and any parts of them refer to the Eskimo's interaction in terms of the sea, the caribou in terms of the land. The activities in which they exploit the animal population of both these environments come at different seasons and are opposed. If a man wears a caribou symbol while seal hunting, therefore, it might magically prevent his success; i.e., it might remind him of caribou hunting and upset his concentration on his present task.

In Polynesia, and in a good many other regions, a commoner cannot sit or stand so that he is physically higher than a chief. The spatial position in this instance symbolizes the position of the individual in the administrative hierarchy, and anyone using the wrong symbol, i.e., standing or sitting in the wrong position, would get into serious trouble, and in some cases might be killed. The relative positions of the members of the set during interaction in the political institution reinforce symbolically the regularity of the order of action, and anyone who takes the wrong symbolic position will disturb the equilibrium of the group.

In the same way, a soldier must wear his uniform at drill; he cannot come in a pair of bathing trunks or in a dinner jacket. In church, men must bare their heads and women must cover theirs; men must wear sober garments and not sporting or work clothes; women must wear long dresses and cover their arms. In other words, symbols of activities in the family, the economic institutions and other systems must be subordinated to the symbols of the relationships of the people in the political and religious institutions, respectively.

The Intensity of Symbols. In these examples the intensity of the "belief" in the conflicting symbols varies in terms of the differences in interaction rates of the opposing systems, and this in turn determines the degree to

which the interaction in question, and its associated symbols, play an antagonistic role. Belief in a symbol may be defined as response to a symbol. A church to a man is a symbol of his relationships in it with his fellow members. A man who seldom attends, or who attains little of his adjustment within the walls of the church, may feel mildly embarrassed if after the action of the minister, he rises in his pew while all the others kneel. On the other hand, a devout believer, who maintains his equilibrium to a greater degree through the church than through any other agency, would suffer deep pangs of remorse at such a failure to synchronize. In the same way, the Polynesian who might by mischance sit in the wrong position in reference to his king would undergo an extreme emotional response, so intense that he might become violently ill or even suffer momentary paralysis.

The intensity of a belief, therefore, is determined by the intensity of the interaction in the relationship to which the symbol refers. When people attempt to explain their beliefs they ordinarily give a description of the emotions which the particular symbol evokes, and also tell something about the situations in which they have experienced these emotions. Insofar as the emotion is intense, so is their belief, and most people assume that this property of intensity, which is the result of the effect of their system of relations upon their autonomic nervous systems is a guarantee of the "truth" of the belief. Actually, of course, this assumed relationship is by no means necessarily true; in fact it is much more frequently true that strong emotions prevent one from ascertaining what is actually happening. The psychologists use the term "rationalization" to describe this process. What they mean by this word is that we tend to invent reasons in terms of the combinations of symbols to which we have been conditioned to convince ourselves that our emotional reactions are characteristic not merely of ourselves but of the universe.

If my particular experience has conditioned me to be unable to adjust in certain types of institutions such as schools or churches, it is natural for me to generalize and try to point out that schools and churches are harmful and ought to be done away with. Unfortunately this type of verbalization is too frequently taken seriously. Instead of recognizing the emotional basis for the belief, we are likely to try to argue for or against without any operational methods of determining whether or not the rationalization is a description of the facts. Unless we are scientists and have studied how conditioned responses are formed, we do not as a rule actually know, and even then, when emotionally stirred, we are likely to forget the part played by this mechanism and take our rationalizations seriously.

Conclusion. Since this question of the conditioned nature of symbols is a basic prerequisite to the understanding of the whole subject of ritual as well as of other symbolic configurations and activities, a brief review may be in order.

All human activities involve interaction, directly or indirectly, and most interaction takes place in institutions. Each institution consists of one or more sets of relations. As the members of such an institution interact, symbols also develop to refer to these interactions, and these symbols are derived from the contexts which accompany the interaction. The symbols refer not only to the quantitative properties of the interactional adjustment, but also to the relative positions of the different individuals in the sets in the system, such as the leader, the followers, etc.

We have already seen how, within the family system, different terminologies, that is, different groups of words, arise to symbolize the kinds of relationships found in different types of family. Within such a system, it is the repetition of events between the same people with differing content that brings about the development of symbols which refer to each.

In the next four chapters we shall be concerned with the crises which disturb the individual and the group, the institutional aspect of which we have already discussed in Chapter 16, Religious Institutions. We shall consider in some detail the techniques and their derived symbols which are employed in restoring the equilibrium of individuals and of groups after it has been upset by these crises, and we shall see how these symbols and techniques develop, as a means for the systematic expression of the relations of individuals in their various institutions, through the Rites of Passage and of Intensification.

Throughout this discussion we shall try to make it increasingly clear that the importance of symbols lies in the way in which they contribute to the maintenance of the conditioning of the individual in his various relationships. Symbols maintain the contexts of situation found in the interactions of individuals by enforcing the use of specific words, objects, and techniques which the individual is already accustomed to use in other situations. He thus takes over into one institution the interactions learned in another, and the maintenance of the ordered relations in such institutions is consequently made easier for its members, and hence stabler.

Mammals differ from other animals in that a greater proportion of their behavior is the result of conditioning. Man requires more conditioning than any other mammal. Symbols play an essential and necessary part in the conditioning process. Therefore man uses symbols more than any other animal, and the more complex the society in which he interacts, the more

complex his use of symbols. This will be particularly brought out in Chapter 24, in our study of language, the most frequently used of all symbolic configurations.

SUMMARY

Human behavior can be described in terms of the quantitative properties of interaction, i.e., of stimulus-response situations. Symbols, by means of which all interaction takes place, can be understood in terms of these quantitative properties.

Symbols, as we saw in Chapter 3, are repetitive elements taken from the context of situation of an event. A symbol may be anything—a word, place, condition, the sun, a tree, a man, etc., which refers to the relations between persons, between persons and objects, or between persons in terms of objects. In most cases symbols are directly associated with interaction; a religious symbol, for example, is associated for the individual with his relations to the other members of the religious institution.

A symbol is selected from the context of situation, not only because it is a constant element, but also because it is, compared to the others, relatively striking or easily perceived, like the colors red and white. That is why albino animals are often used symbolically to represent people's relations in terms of a particular species.

The perception of a symbol evokes an emotional response, but the interaction which it symbolizes must be repeated or it will become extinct, that is, it will fail any longer to evoke that particular response. That is why all ceremonies, which are symbolic actions, are based on the regular performance of specific interactions which are associated with symbols taken from the context of situation.

Symbols may change their specific meaning as the relations to which they refer are changed. "Bless" used to mean "to sprinkle with blood"; heathen priests used to do this to their clients. The specific meaning of bless has changed, but the meaning in terms of human relations has not.

All symbols which refer to the same interaction rates are equivalent to one another. Among Plains Indians buffalo and corn both symbolize interaction within the political hierarchy in controlling the techniques of obtaining and preparing the principal foodstuffs. The two are therefore linked in ceremonies, or one can be used in place of the other. Other symbols may be antagonistic since they refer to different relationships and cannot, therefore, be used together. A man cannot wear women's clothing, and a grown man cannot carry a rattle without ridicule. The antagonism of symbols serves to preserve the isolation of systems and to maintain the

habitual interaction rates in them. The intensity of our belief in symbols depends upon the intensity of our emotional experience, which is due to the effect of our interactions upon the autonomic nervous system. Intense emotional experience is no guarantee of the scientific validity of belief; everyone tends to rationalize to justify his emotions.

The importance of symbols lies in the way that they contribute to the maintenance of conditioning in the individual in his various relationships: i.e., in the way that they help regulate and canalize behavior. As we shall see presently, they also help condition him to cope with change.

CHAPTER 20

Rites of Passage

I. INTRODUCTION

Throughout life, each individual undergoes changes in his relations to others. Some of these are changes within a single system. For example, the personnel of his family inevitably changes through births, marriages and deaths. Then again, the individual may start to interact in other institutions and thus enter new relationships, and within these new institutions he may change his position in relation to others several times. Each such change disturbs the individual's equilibrium, involving changes in his interactions in his whole system of relations.

Any disturbance which involves marked changes in the habitual interaction rates of individuals is called a crisis, as we have already noted in Chapters 16 and 18. The first stage in the restoration of equilibrium after a crisis is obtained by a ritual or ceremony. In these ceremonies, the new system of relations of the individual is dramatized in such a way as to condition all the disturbed individuals to the order, amount, and frequency of the new interaction rates. Through the agency of the conditioning process, these ceremonies serve as mechanisms of transition, to ease the individuals concerned in passing from one state of equilibrium to another.

For this reason Van Gennep,[1] who first recognized the significance of this type of ceremony, called them "Rites of Passage," since they literally mark the passage of an individual from one state in his relations with other people to a second state. He showed that all such ceremonies—in fact, all ceremonies—could be divided into three consecutive parts, always occurring in the same order, and he called these parts, in French, *separation, marge,* and *aggregation*. These we shall translate as *separation, transition,* and *incorporation.*

We shall see a number of examples shortly in which these three stages can be readily identified. For the present, however, it may suffice to state that each consists of a change in interaction rates, dramatically acted out

[1] Van Gennep, A., *Les Rites de Passage,* Paris, 1909.

in a uniform way. The first stage, separation, involves a marked reduction, or even a complete cessation of interaction between the individual and the group in which he or she has been interacting. For example, in some marriage ceremonies, already mentioned in Chapter 13, the kinsmen or friends of the groom go to the house of the bride's family and without responding to the actions of others, forcibly break off the interaction as they take her away. In a great many Rites of Passage, the ritual of the first stage consists of pretending to die, and lying motionless to indicate the complete separation of the individual from his old system of relations.

The second stage is a period during which the individual interacts within the new system, but has not yet returned to his other relationships. This period may vary greatly in duration, from a week-end honeymoon in our own society to the seven months' instruction in ritual received by a novice in the Legba cult in Dahomey, a period during which he has no interaction outside the institution. Ritual associated with this stage takes the form of acting out (learning) the relations which the individual is to assume within the new institution.

The third stage, the period of incorporation, involves a ceremony in which the individual begins once again his interaction with the members of his community, this time as a member of the institution in which he is now to play his part. In many societies, this is dramatically acted out. The initiate is regarded as "new-born," and in the ceremony he is born, fed in child fashion, taught to walk and eat and is reintroduced to the other personnel of his system, including the members of his own family. Every Rite of Passage is made up of these three parts, but the durations and complexities of the interaction in each stage varies considerably in response to the requirements of the systems in question.

The Difference Between Rites of Passage and Rites of Intensification. In Chapters 16 and 18, we have already mentioned the Rites of Passage and the crises or disturbances that bring them about, but it may be useful here to distinguish once again between those changes in the relations of groups which are followed by the Rites of Passage and those which are accompanied by Rites of Intensification. As we saw, it is the periodic changes, as a rule, which require Rites of Intensification; the daily, weekly, monthly, or yearly changes which are associated with changes in technology through the alternation of day and night and of the seasons. The Rites of Passage, on the other hand, are usually associated with non-periodic changes such as birth and death, illness, and so on.

Most characteristically, however, the non-periodic changes producing the Rite of Passage affect a single individual specifically, and the rest of

the group only through their relations with him, while those producing the Rite of Intensification affect all the members of the group together. In all cases except sickness and injury, the Rites of Passage involve a change in the actual personnel of the systems, while this is not the case with the Rites of Intensification. Even if a number of persons are initiated or die or are married at the same time, the same differential effect on their systems of relations occurs. Each change affects a single person in the system, not all of them together.

Types of Crises Which Evoke Rites of Passage. The crises which are followed by Rites of Passage are most typically those which primarily affect the family system. They include such major changes in relationships as birth, puberty, marriage, death, illness, and injury. These crises, of course, also affect tangent institutions, where such institutions are found, and death in particular requires a reorganization of interaction rates in every institution in which the deceased took part, and hence a ceremony in which they all participate. For example, the death of a prominent man in our society may involve a funeral attended by his business associates, fellow veterans, fellow club members, and fellow church members, as well as his family. The members of his fraternal organization may drop fern leaves on his body while the coffin is lying open, and after the clergyman has pronounced the rites at the cemetery, soldiers may play taps on a bugle and fire a final salute.

In the relatively complex societies, one finds frequent changes in the positions of the individuals in systems outside the family, and these changes include the initial act of joining each institution and the subsequent shifts of position in the hierarchy within it. All of these changes, whether familial or otherwise, represent crises in which habitual interaction rates are disturbed and new relationships begun. As we shall see, the ceremonies which follow these crises serve in similar ways to restore the group in question to a new level of equilibrium.

The Quantitative Differences Between Rites of Passage. For each crisis, the ceremonies which we shall consider differ in complexity and in the extent of the relations involved, both individually and as types. These differences depend upon the magnitude of the change in the relationships of the individuals involved and this in turn depends upon the ramifications of the relationships of the individual causing the disturbance. In many groups, for example, the death of an infant whose interactions with his family and others outside have been of very short duration will produce a crisis for the parents only, and when any ceremony is held, only members of the family will, as a rule, attend. Among many North American tribes, the

child may be buried without ceremony, under the house, and in these cases it is clearly seen how the intensity of the ceremonial is related to the quantitative values of the interaction rates concerned. Similarly, among hunters and pastoralists living in unfavorable environments, a very old man is merely a hindrance to the others in their routine activities, particularly if the group is continually on the march. Such a person has already ceased to interact at a high rate and his death will be little noted. In some places, as among the Eskimos and Australians, a very old man will be killed or left to die so that he will not be a burden to the group, and in these cases no ceremonies are held. The death of an adult male, on the other hand, when he is in his prime and interacting in a number of institutions at a high rate, is a much more serious matter, and the ceremony will bring into interaction a large number of people.

When a powerful king or emperor dies, the disturbance may affect the equilibrium of thousands, or even millions of people. Its intensity may be so great that the ceremonies following the death may involve a tremendous attendance, extraordinary expenditure, and years of mourning for his subjects. When, for example, Mangu Khan, the grandson of the great Genghis, died in China, his followers, who brought his body to the royal cemetery in the Altai Mountains killed over 20,000 people whom they met on the road, and he was buried with servants, horses, and women, in the midst of finery.

This principle applies not only to funerals but to other ceremonies; in the case of weddings, for example, there is a tremendous difference between that of a humble couple in a small village, or a pair of factory workers, and the wedding of two persons whose parents are wealthy and prominent. A royal wedding is a national holiday, and in the ceremony members of the various institutions within the kingdom all have their part. The birth of an heir to the throne is also the occasion for much ceremony.

Where the male set is stronger than the female, the birth of a son is always celebrated with much more enthusiasm than that of a daughter, which may evoke no ceremony at all. In the Rif, the relatives sit around in the courtyard awaiting the word from the midwife; if it is a boy, the men begin shooting off rifles and shouting; they slaughter sheep for a feast, and the young women warm up their drums for dancing. If the child is a girl, the men eat some of the food already prepared and then go quietly to their homes. If the child is a boy, the men meet again a week later and hold another feast, at which they take up a collection of money for the mother who has given the group a new warrior.

The Number of Persons for Whom a Rite of Passage Is Conducted. As we have stated, Rites of Passage are held in response to disturbances within the group, and these disturbances usually involve one person at a time only. Hence many of them, as a rule the majority, are held singly. There are circumstances, however, in which they may be held for whole groups or classes of persons at one time.

In Australia, for example, and in many age-graded societies, the people wait until a number of boys have arrived approximately at the age of puberty, and then put them through the initiations together. This is particularly effective, because it gives the initiators the opportunity to originate to them in set events instead of singly, and set events are more effective in the conditioning process.

Aside from puberty ceremonies, the principal crisis that occasions mass rites is death. This may happen in time of a pestilence, as in the days of the plague of London, so graphically described by Defoe, or, more often, at times of mass killings, as at Coventry in 1940 when the victims of the German air raids were buried with a single rite in a huge common grave. Many people, however, do not require such wholesale death as the background for mass ceremonies. The Iroquois had a ceremony held every few years in which they dug up the bones of their relatives who had died since the last such ceremony, painted them red, and reburied them. The Nicobar Islanders similarly disinter their dead at regular intervals, "feed" cocoanut milk to the skulls, place hats on them, and finally throw them away in the bushes outside the graveyard. In both these cases, and in many others of a similar nature, an attempt is made to place these rites on a regular periodic basis such as that which governs the performance of Rites of Intensification. These rites serve to mark the end of the period of adjustment, which varies in length according to the importance of the individual. In the Nicobar Islands, if the skull of a man who was of unusual importance, that is, of one who had a high interaction rate and originated to a large number of people, is dug up at one of these ceremonies, and if his relatives recognize it, or if they identify a particular skull with him, then they will put it back again and let it stay in the graveyard longer than the others. Thus it may take the space of two or three such ceremonial periods for the disturbance caused by such a man's death to die down.

II. SPECIFIC CEREMONIES ILLUSTRATING RITES OF PASSAGE

The rest of this chapter will be devoted to giving a series of examples of crises and the Rites of Passage associated with them. These examples

have been chosen not only to illustrate the fact that the disturbance of the individual's equilibrium is temporarily righted by the prescribed interaction in the ceremony, but also to show how the symbolic content of each of these ceremonies helps to reinforce the prescribed behavior through an emotional stimulation. In our discussion of symbolism we have already indicated how, in any kind of interaction, the regular repetition of a sequence of contexts of situation, each of which is made up of a single event, produces automatically a symbol or group of symbols which stand for this sequence. However, these symbols do not stand for, or refer to, these interactions alone, for since the interactions themselves are built up out of the processes controlled by the autonomic nervous system, they also refer to the emotional level at which the interactions occur. In what follows, therefore, we shall briefly analyze the ceremonies employed in a number of specific crises, to determine the principles on which each of them works.

Birth Ceremonies. We shall begin our discussion of life crises by describing some of the ceremonies associated with the birth of a child. The example that we have chosen is from the Buka people in the northwestern part of Bougainville in the Solomon Islands.[2] Among these people the beginning of pregnancy is symbolically marked; the woman makes a belt of a special creeper and wears it in place of a loin cloth; furthermore, during pregnancy, she has to abstain from eating certain foods. Toward the end of pregnancy, a ceremony is performed to make delivery easy. When the expectant mother feels the childbirth beginning, the husband goes to fetch one of her female relatives and then goes to another hut where he must spend his time in complete idleness for three days. During this period, he must on no account carry or lift a heavy object, or touch a knife, ax, or any sharp instrument. It is believed that if he did so, the child would be injured. On the fourth day, he can go to the hut to see his child. He can now wander around the village, but may not go outside or do any work. On the fifth day, he and his wife go down to wash in the sea, and then go back to the hut, where he takes an ax or knife and pretends to cut the child. Once this has been done, he may return to his daily activities.

This and similar customs by which a husband undergoes a marked change in his activities, is called the "Couvade." Its significance is easy to understand. When the process of labor begins, the woman's habitual interactions are seriously disturbed, as are her husband's. The ordinary relationship between man and wife is broken down, and she is surrounded by women, midwife and helpers, who look after her during the period of labor.

[2] Blackwood, Beatrice, *Both Sides of Buka Passage,* Oxford, 1935.

In order to maintain the equilibrium of the system in which the woman and her husband live, the man also reduces his interaction and does not interact with anyone at all during this period. Since he is in a disturbed state, this regulation affecting his rate of interaction in other systems outside the family prevents him from making compensatory changes in other systems of relations as he normally would in response to his disturbance. This prohibition is symbolically reinforced in several ways: not only must he forego his habitual relations with other men at the clubhouse, in hunting, and in the fields, but he also is forbidden to employ the symbols of masculine activity; he cannot cut anything with a knife or ax, or lift a heavy weight. By the prohibition of such symbolically masculine activities, he is prevented from returning to his habitual interactions in other systems, which might disturb others if he over-compensated.

His reintroduction to his normal rate of interaction begins on the fourth day, after he has seen his wife and child and is allowed to wander around the village once more although not to work or take part in any activities outside, such as hunting or fishing. On the fifth day, he and his wife interact in a prescribed pattern, and he then originates to the child with the symbol of masculine activity (the ax), which had previously been forbidden him. For some time longer, while the child is very small, the parents are not allowed to eat meat or fish, since both of these foods are obtained by males in events in the male set, and this reduces the frequency of these events and allows an increase in the parental set, since the father does not go hunting. It is believed that these foods if eaten by either parent would hurt the child, an indirect way of expressing this situation. Actually these prohibitions serve as the final tapering off of the restrictions which have maintained the equilibrium of the group during the crisis which has now almost completely disappeared, since by this time the parents have resumed their interaction with each other which the birth of the child disturbed, and have begun their adjustment to the child.

Puberty Ceremonies. Until a child approaches his middle teens, no serious change in his relations ordinarily takes place, since his interactions have been almost entirely confined to the members of his immediate family and to children of his own age. About the age of eight or nine, he may begin to perform some of the simpler techniques with which he will later be concerned as an adult, and much of his learning will be under the direction of his father, his elder brother, or maternal uncle, depending on the type of family system in which he lives. Toward the end of this conditioning period, which usually more or less coincides with puberty, the growing child, in the simpler societies, is initiated into its adult relationships. In more com-

plex societies like our own, where formal conditioning takes much longer, puberty ceremonies, like high school graduation, may not be followed immediately by adult status. College may follow, with a consequent prolongation of the childhood status.

One of the clearest descriptions of the factors involved in initiation is contained in Radcliffe-Brown's account of the Andaman Islanders.[8] We are including this here, and merely remark in passing that similar initiation ceremonies are found for the girls, and that in almost every society where puberty rites are observed there is some kind of a female initiation ceremony as well, although in many cases it is not as extensive and elaborate as that of the boys. In cases where the change in position of girls involves little more in the symbolic sense than the adoption of a new type of dress, we find that there is also at this time little change in the interaction rates of these girls with the members of their families. The duration and the amount of interaction in the Rites of Passage associated with initiation are, therefore, direct functions of the adjustments of the family system in its tangent relations to other systems.

At the beginning of his period of initiation, the Andamanese boy ceases to live in the hut of his parents and stays instead throughout the period in the bachelors' hut. From this time until his marriage his parents originate to him continuously and expect him to do whatever they ask. Before this time his interaction rate was high and he did not terminate with invariable frequency. The reduction in the amount of interaction between the child and his parents is compensated for by the parents' increased origins; the boy's interaction, of course, can go back to normal, in amount at least, in the bachelors' hut. Following this change in his habitual relationships, he undergoes the painful ordeal of having scars cut in his back and chest. From this time on, he also abstains from eating certain foods, a fact already referred to. Among the bands that live on the coast, there are two stages of abstention. During the first of these periods, the boy abstains from turtle and dugong and several associated foods, mostly sea foods, but including a few vegetable products. At the second stage he is allowed to eat these sea foods, but he is forbidden to eat pork and associated animal and vegetable foods, mostly of land derivation. Among the inland, forest-dwelling bands, where sea food is eaten only on visits to the coast, there is no interaction derived from turtle and dugong hunting, and hence the important ceremonies are those associated with eating pig, honey, and a freshwater fish called nyura. This period of abstaining from special foods lasts any-

[8] Brown, A. R., *The Andaman Islanders*, Cambridge, 1922.

where trom one to three years, depending on the decision of the men in charge as to when the youth has gone through this ordeal long enough.

In the ceremonies just described, the period of separation is marked by the scarifying ceremony, in which the members of the band hold a dance and the boy is required to dance all night with them, thus interacting at a high frequency with the members of the group. At daybreak, after the dance, he bathes in the sea for about two hours, and then his back is cut, and he remains silent throughout this time. Thus the marked increase in interaction during the dance is followed by the origins of the old man who cuts him, and this in turn is followed by the brief period after the operation when he interacts with no one. The period of transition is the period after his scarification when he lives in the bachelors' hut.

During this period, which, as we have said, may last as long as three years, the boy does not interact with his family with a fraction of the frequency which he did as a child. He lives in a bachelors' hut with widowers and unmarried men, and when the other members of the camp are feasting on one of the foods forbidden him, he cannot take part in the interaction, and very often when there is nothing else in the camp he will go hungry. This period will be brought to a close by the ceremony marking his incorporation into the activities of the group, although he still may have to undergo another set of prohibitions before he is free to leave the bachelors' hut and get married.

When the older men decide that it is time for him to begin eating turtle again, they arrange a turtle-hunting ceremony, and a number of turtles caught at this time are cooked for the occasion. The boy is seated on hibiscus leaves in a small, special hut, and is faced in a special posture toward the sea. Then a fire is built between him and the ocean. The man who is to conduct the ceremony rubs turtle fat over the youth, then covers him with red ocher, and feeds him turtle fat. During this process his female relatives weep loudly. After this feeding the man massages him and covers him with white clay.

For forty-eight hours the boy must now sit on the hibiscus leaves, eat nothing but turtle, remain awake and not speak. During this period the man in charge of the ceremony gives him instruction as to what food he may and may not eat after the ceremony. On the morning of the third day, a necklace of pothos creeper is put around his neck; he has a bath and is then decorated again with red paint and white clay by his female relatives. On the fourth day a dance is held in which the boy and five or six men take part, and each of them holds a bundle of hibiscus twigs. A man sings a song about turtle hunting, the women act as a chorus and the

dancers imitate the movements of a turtle as it swims through the water. After this the boy returns to the initiation hut, where he may now talk to his friends; the dance is repeated for two more days and after that the youth resumes his ordinary life, though for a week or so he may not touch a bow and arrow. The pig-eating ceremony is very similar, except that instead of hibiscus, the twigs and leaves of the tetranthera are used, which is the wood used to make pig arrows.

In the turtle-eating ceremony, the first activity consists of seating the boy on hibiscus leaves and placing him in a complicated posture. A fire is then built between him and the sea. Here, to begin with, are two complex, symbolic situations which require explanation. We have already seen how hibiscus is primarily associated with the techniques used in maritime activities. It, therefore, symbolizes the interactions of individuals who are hunting turtle, since it represents, as we have shown in the last chapter, a constant element in the turtle-hunting technique. In the ceremony which reintroduces the boy to the products of the sea, we can see an essential change in his relations, which involve symbolically building up those interactions which are tangent to the hunting activities of the older men. For a period of a year or so, these interactions have not taken place, and coincidentally the symbols which refer to them have also been forbidden him. Thus there has been a definite antagonism between the symbols of the two systems—the family and the turtle-hunting group. In building up the frequencies of the interactions, therefore, a member of one system, the turtle-hunting, turtle-eating group, originates to him and builds up the interaction. The interaction which takes place is a series of events in which turtle meat is used first as decoration and second in the act of feeding.

The fire which is built between the boy and the sea is a symbol of the interaction of all the members of the group. It is a constant part of the context of situation in meals and feasts and in evening dancing. It is, therefore, associated with the context of eating turtle meat but not with its capture, and its use in this ceremony is to indicate that the entire group is in interaction, while its location represents the transition between the two systems. At each stage of the decorating and feeding, the female relatives weep, and it should be pointed out that among the Andamanese, weeping is a method whereby two individuals or two groups greet each other after a period of separation, just as in our society we shake hands.

Their response to the actions of the master of ceremonies and of the boy, therefore, represent a series of set events in which the males originate action, and the action symbolizes an increase of the frequency of interaction between the boy and the women, which, during his sojourn in the

bachelors' hut, in his abstention from any feasts, was necessarily diminished. The use of the clay symbolizes the condition previously described as "ot-kimil," representing any change in the relations of the individual. This method of decoration is apparently used in all "ot-kimil" situations. The dances in which the boy finally takes part bring about a very high frequency of interaction between himself and all the other members of the society, and after each period of dancing he is allowed to interact freely with his friends.

These and other initiation ceremonies make up the period of change in the relations of an Andamanese from his position as a child within the family group to his assumption of adulthood and marriage. During this period he must abstain from a number of activities, and the symbolic aspect of the ceremonies through which he passes represents the linkage of the objects in the context of situation concerned with the changes in his interaction rate. In other words, our analysis of the symbolism shows us that objects to which the individual had previously been conditioned, and to the use of which he must once again accustom himself, are the essential elements in the ceremonies. As we shall see in all Rites of Passage, this principle is maintained, and the significant element in the symbolism of every ceremonial is that only those symbols are used which refer directly to the systems involved and to the changes in the interaction rate.

Although space prevents further description and analysis of puberty rites, it should be pointed out that the custom of mutilating or marking the candidate in some way is extremely common. In some areas of Australia, the natives not only scarify the boys but knock out one or more front teeth, circumcise, and subincise them. The latter operation involves slitting through the lower side of the penis to the urethra with a flint knife. Scarification is common in Africa and Melanesia, and tooth-knocking is also found in the former region. Tattooing is another method commonly employed among lighter-skinned peoples, such as American Indians, Polynesians, and the more primitive whites. In all cases the explanation is the same: the individual is marked by a symbol of the relationship of the group which he is entering; i.e., the mark indicates his membership in that group. The act of mutilation is at the same time an essential step in the ceremony.

Another point that might be mentioned is that among many peoples the puberty ceremony serves as a period of instruction, comparable to our childhood schooling. By frightening the boys with masked figures supposed to represent spirits, as is done in Australia, Tierra del Fuego, and elsewhere, and by making them hungry and keeping them awake, they are placed in a physiological condition in which they will terminate readily to the

origins of their teachers, and will not forget the lessons learned at this time. As the old-fashioned teacher would say, "When they are in my classes, they *learn* discipline."

Funeral Ceremonies. If we take up other examples of Rites of Passage, we find precisely the same principle illustrated in the last section in operation. This is perhaps more strikingly brought out in the case of funeral ceremonies, where the significant elements in the changes in the family system are systematically acted out. In order to illustrate this point we shall select parts of the ceremonies from two different groups which are chosen because they are not too long and detailed for the space we can give them.

To begin with, we shall select the first stages of the funeral ceremonies among the Murngin tribe of Northern Australia, which have been described by W. L. Warner.[4] These funeral ceremonies consist of a very long series of rites, which mark a number of stages in the changing equilibrium of the group. The first stage involves the rites which take place while the man is dying and the ceremonial activities immediately after his death. These are the only ones which we shall now consider, but it should be pointed out that these rites are followed by a big camp ceremony during which the man is buried, another ceremony two or three months later, when the body is dug up, the bones removed and put in a tree, and a final ceremony two or three months after that, in which the bones are placed in a coffin and left to rot.

When a man is dying, his relatives gather around him and wail, and some of them, under the direction of a leader, sing the songs of his moiety and clan. These songs describe the totem of his group, that is, the different animals and objects which symbolize his clan, and as each totemic element is mentioned, the dying man is supposed to imitate the movements of the totemic animal. After the man dies, a stillness comes over the camp and the ordinary noise and chatter are not heard. The female relatives cut their heads with flint knives or sharp sticks, and the relatives paint the appropriate totemic symbols upon the corpse. Thus if the deceased belonged to the duck clan, he would have the design of the sacred well, one of the symbols of that clan, painted upon him. This is the same symbol that is painted on a boy of this clan during his circumcision rites and also when he sees his totemic emblem for the first time.

The relatives then move their camp away from the grave, and after this the members of the group, divided into moieties, proceed to the camp ground, carrying fire-sticks. The father of the dead man, or a kinsman in the classificatory position of father, takes a large cake of palm-nut bread

[4] Warner, W. L., *A Black Civilization*, New York, 1937.

which the women have made for him, and distributes pieces to members of his own moiety and that of the dead man's mother. This action is supposed to force the soul of the dead man to leave, because he is not able to eat any of the bread. The father then builds a small fire and places some leaves on it, leaving them there until they begin to smoke. Then he takes them off the fire and brushes them over the bodies of all the male and female relatives of the deceased. After this, the dead man's female relatives talk among themselves, and supposedly to the body. This ceremony is then followed by the main camp ceremony, during which the man is buried, a rite which we shall not consider here.

The elements in this ceremony are very simple. The first of these consists of sustained interaction of the relatives with the dying man until his death. This interaction involves singing the sacred songs of the man's group, and these consist, in effect, of the description of all the emblems which have symbolized his past interaction. Not only does he hear these, but he also endeavors to respond at the proper place by acting out the movements of the totemic animal of his group. Once the man starts to die, therefore, the members of the group are in constant interaction, and as soon as he dies, they begin to readjust their relationships.

The symbolic elements of the initial rites which we have just described are very simple. They consist merely of the use of fire and food, the symbolic significance of which needs little explanation, since both of them represent the sustained habitual interaction of members of the group. The essentials of the ceremony, therefore, are the division of the individuals into their moieties and the formal interaction in which the father of the deceased originates to each member of the moieties of the dead man's father and mother, first by giving each person a piece of palm-nut bread, and then by brushing them with leaves. The final stage in this sequence involves the interaction of the dead man's female relatives on both sides of the family, which are in this way brought together. The symbolic expression of the change in the system of relations is that since the deceased cannot eat the palm-nut bread, i.e., cannot interact with the other members of his group, he, or his soul, goes away.

Among the Toda of southern India,[5] the funeral ceremonies involve an even more precise delimitation of the kinship groups of the deceased. As we mentioned in Chapter 9, these people subsist almost entirely upon their herds of buffalo, which they milk. At the funeral a buffalo is killed and the hand of the dead man is placed on the horn of the buffalo. Then the men come up to the buffalo, bow down and place their foreheads on its

[5] Rivers, W. H., *The Toda,* London, 1906.

horn. Then all the people gather around the dead buffalo and the corpse, and weep together, placing forehead against forehead, each man calling out the name of the buffalo and the name of the family relationship which he (the weeper) had with the dead. Everyone would pair off in turn with everyone else and lament.

During or after this lamentation, a ceremony called "kachutchti" or "cloth he puts," was performed. The essential feature of this ceremony is that a near relative of the dead person gives a cloth to the men who have married into his family, and the wives of those to whom it is given place the cloth on the dead body. In this ceremony the father of the deceased, if he is alive, or otherwise a clan elder, also gives a cloth to one of the dead man's brothers-in-law. The latter gives the cloth to his own wife (the dead man's sister or wife's sister), or to some woman he would be allowed to marry, and the woman places the cloth on the corpse. The man who originally gave the cloth takes it from the body and gives it to another brother-in-law, and this sequence is continued until the cloth has been given to all the brothers-in-law present. After the ceremony, each son-in-law has to give a buffalo to the father of the deceased man, and when a woman has taken part in twenty of these ceremonies, her father is paid the sum of twenty rupees by her husband.

The significance of these ceremonies can only be understood in terms of the way the sets of relations operate among the Toda, and of their buffalo-herding technology. In the first place, the Toda cannot afford to kill buffalo very often, and, in fact, only do so on ceremonial occasions such as this. Thus the act of providing meat to all the participants in the ceremony is an act of originating to all who eat it in a family rite.

When the hand of the dead man is placed on the horn of the buffalo, he is associated with the principal symbol of technological activity of the people, and then becomes part of the context, with the buffalo, when all the men kneel before it. Here then, the men, who alone have charge of the buffalos, interact in a group event. Next all the people weep in pairs and call out the names of the dead buffalo and the dead man, and their kin relationships. Thus the first part of the ceremony serves to enforce interaction, first among single pairs of relatives and then among the corpse's entire kinship group. This is comparable to the giving of the palm-nut bread among the Murngin.

The cloth-placing ceremony serves to adjust the relations of the dead man's immediate kin with each other. Among these people, when a man marries he begins giving gifts (originating action) to his wife's brothers, and only after a long period of regular gift-giving is his relationship with

them stable enough to enable him to take over their sister. In the same way, the men married to his own sisters have gone through the same lengthy procedure of making gifts to him. Thus when a man dies, his death disturbs not only his habitual relations with his father, with whom he has associated constantly in herding and dairying activities, but also those with his sisters and their husbands.

In the cloth-giving ceremony the father originates action to all those who have, in the past, originated to the deceased in building up relations through marriage between the two clans. In the sequence of events which make up the ceremony, the father originates to his daughters' husbands, who in turn originate to their wives and they to their father. In this ceremony, therefore, people who are related by marriage act out in a formal manner the habitual order of interactions involved in their relationship. The relationship of the dead man's clan to the other clans with whom he was connected through his sisters is reinforced by this simple ritual technique. By these means the equilibrium of the group as a whole is restored.

An objection might be made that when most men die, they have no fathers. Among the Toda, however, who are polyandrous, any of the men married to the deceased's mother, most of whom would be actually his father's brothers, might serve in this capacity, and a classificatory father may also perform this office in Australia.

Marriage Ceremonies. The Rites of Passage connected with marriage are the simplest of all ceremonies with which we have to deal. They consist of a series of ordered interactions in which the members of one group originate to the members of another, or they both originate to each other. As we have seen in Chapter 13, there is always a general increase of interaction between the two groups, involving, as a rule, gift-giving and feasting. Very often a marriage ceremony proper, such as we have in our society, which takes place before the two people begin to live together, is omitted, but when this is true, there has always been a sequence of set events between the two families, except in the rare instances of true marriage by capture. In some instances, particularly in the more complex societies such as our own, the marriage ceremony as we think of it involves a sequence of responses to the origins of a member of another institution, such as the church or state.

To start with a simple example, we can again use the Andamanese, who are a godsend to the anthropologist because of the extreme simplicity of their technology, systems of interaction, and symbolic configurations. Despite this simplicity the essentials of the Andamanese marriage ceremony

are very much like those found in more complex societies, since the underlying principles are identical. After a marriage has been arranged through an intermediary, and gifts have been exchanged for some time, the marriage ceremony is held on an evening. The bride sits on a mat at one end of the dancing ground, with her relatives and friends sitting near her; the groom similarly accompanied sits at the other end of the grounds.

One of the older men addresses the bride, telling her what her duties are as a good wife, and then explains to the bridegroom how he is expected to behave as a good husband. He then takes the bridegroom by the hand to where the bride is sitting and makes him sit down beside her. The members of both accompanying groups weep loudly. After a few minutes the leader takes the arms of the bride and bridegroom and places them around each other's necks. After a further interval he makes the bridegroom sit on the bride's lap. After they have sat in this position for a few minutes, the ceremony is over. The rest of the community then has a dance, but the married pair, after receiving presents from their friends, retire to a new hut which has been built for them. The day after the ceremony they are decorated by their friends with white clay.

This ceremony needs little explanation; in major essentials it is very much like our own. The leader originates action to the bride and groom and makes them interact, and after several events the ceremony is over. The segregation stage consists of the master of ceremonies leading the groom and bride to their positions, the transition comes when they sit embracing each other, and the incorporation stage when the couple is decorated with flowers. During the entire event, the relatives and friends of both sides weep and wail in response to the leader, who thus equates their interaction by making them common termini in the set of relations in which he originates action.

In order to illustrate a wedding ceremony in a more complex society, we shall outline some of the essentials of the rite among the Riffians, where it is long and somewhat complicated. After the arrangements have been made for the marriage, and the date set, the groom selects seven companions of his own age group, and the bride seven of hers. These companions stay with them for seven days, during which time each of the participants is otherwise isolated. Each night of these seven days a feast is held in the courtyard of each house, with music and dancing, but the principals in the marriage do not participate in it. When they have to go out, they are well covered up, the groom with the heels of his slippers pulled up, and the hood of his cloak over his head and face, while the bride wears a veil.

Before the final night, the bride is tattooed by an old woman, and just

before the culmination of the ceremony, her hands are hennaed, as are those of all her attendants. Two cracked eggs are in the henna bowl. On the final night the bride is placed on a mule, riding in front of her brother or paternal uncle, who holds her. When they arrive at the groom's house the bride and her escort dismount, after which the groom and the escort act out a mock fight with sticks, which the groom wins. The bride throws barley out of a bowl over the assembled guests, and they eagerly pick it up to mix with the next season's seed, since it is supposed to make the seed particularly fertile.

Then the groom leads the bride into his chamber, from which he presently emerges with a reed, which he cuts into three pieces. His companions take these pieces and cut them up into smaller sections, distributing them to his guests. The groom meanwhile enters the chamber with his bride and closes the door; after he has deflowered her, he passes a cloth with the hymenal blood out of the door and this is passed around for inspection. At this point the men fire off guns, the old women trill, and the younger women become very active in their dancing. Several days after the ceremony, the couple make visits among their friends, including a visit to the bride's family.

In this case, the procession by which the bride is brought to the groom and the mock fight with her brother or uncle mark the stage of separation; the segregation of the couple and the showing of the tokens of virginity that of transition, and the subsequent visits that of incorporation. The high interaction rate among the guests is stimulated by the feasting, singing and dancing, as well as by the gunfire. Since the group concerned is an endogamous clan, members of both families take part in all of the festivities.

The symbolic aspects of this ceremony are somewhat more complicated. The covering up and seclusion of the bride and groom before the ceremony are done overtly to prevent them from suffering from evil magic, to which they are supposed to be very susceptible at this time, as they are in a state comparable to what the Andamanese call "ot-kimil." The tattooing of the bride is to symbolize her status as a married woman, and also serves as part of the rite of separation. The eggs placed in the henna bowl overtly symbolize fertility, and the henna itself the act of separation. The design used in both tattooing and hennaing varies locally, and symbolizes the habitual interaction within the clan.

The mock fight, of course, symbolizes the act of separation also, and the fact that the groom wins it represents the dominance of the male over the female system of relations. The scattering of the barley is an act by which the bride originates to all present, the distribution of the sec-

tions of cane is a similar origin on the part of the groom, and these two together serve as a part of the rite of incorporation. The barley is taken from the context of agriculture, which is the chief male activity of the people, just as the eggs are taken from the context of female activities, since in the Rif it is the women who keep hens. The showing of the tokens of virginity is, of course, taken from the context of family relations.

Rites of Passage Outside the Family System. So far we have considered only Rites of Passage concerned with crises which occur within the family, where indeed most of them belong. However, similar rites occur when an individual is initiated into an occupational guild, a religious institution, a political office, or an association such as the Elks or Masons. In one of the best-known and simplest ceremonies in our society, that of baptism into the Christian church, the minister sprinkles water on the novice, or touches him with water, or, in some sects, immerses him in water. The religious leader thus originates to the novice in the presence of the initiates, and the symbol used is the act of washing, which stands for a removal from or cessation of the novice's previous system of relations.

One of the most dramatic and complex of all known rites of initiation, or series of such rites, is that of the Poro Bush society, formerly practiced by the Mano people in Liberia and reported by Dr. George Harley.[6]

The Poro Bush is a complex religious institution which includes an age-grading system with departmentalized schools. It, therefore, is made up of the members of skilled crafts and professions. It serves as the system in which males are initiated, while an auxiliary organization, the Sande Bush, does the same for all girls. The Poro Bush is held once every six years, and all boys have to go through it. The Sande is held also once every six years, and each of them takes two to three years. Since the two are held alternately, one or the other is going on most of the time.

The Poro members build a raffia fence at one side of the village, blocking off an area in the forest, which no one may enter unless he is concerned with the ceremonies while the school is in progress. Inside the enclosure they build houses for the officials, and block off three main sections. In these sections they will initiate three classes of individuals: the ordinary boys, those who are nobles and who will be concerned with government, and those who are to be Zos, or doctors, that is, skilled physicians, blacksmiths and the like.

Each set of boys goes through a different training. Among the Zos there are many higher degrees comparable to those of the Masons, each

[6] Harley, G. W., "Notes on the Poro in Liberia," *Peabody Museum Papers,* Vol. 19, No. 2, 1941; also *Native African Medicine,* Cambridge, Mass., 1941, Chap. 10.

of which requires an elaborate initiation. Among the nobles there is a similar elaboration, with a supreme council at the top which controls the political organization of the group as a whole through tangent relations, directly comparable to Tammany. The members of this council are called "Skin-Men" because they sit on skins at the meetings. When one of them is about to die, the other members take him off in the bush and conceal his death from the public. After a while when people begin to wonder what has happened to him, a dancer appears wearing a mask reproducing his features, and this dancer appears in many ceremonies for a number of years until the disturbance caused by the loss of this leader has died down. Thus the death of such a man is allowed to cause the least possible disturbance.

For present purposes we can dispense with the organization of the Poro itself, which is quite complex, and confine ourselves to an actual initiation ceremony into the lowest grade. In the first place, the Poro period is worked up to gradually, with more and more masked dancers appearing in the village to frighten the women and children, and to change the general adjustment of the people from a system of relations in which civil government is in force to one where the chief temporarily loses his power and the Poro organization is in control.

When the excitement has reached a high enough point, the masked dancers round up the boys, and take them to the raffia fence while their mothers watch. Before they reach the fence, however, each boy is taken first to a secret house where he is dressed up in a shirt inside of which are a plantain stalk and a bladder full of blood. In front of the raffia fence, one of the dancers appears to run a spear through each boy in turn. The boy falls with the spear sticking out of him, and blood flows. The boy, obeying instructions, falls as if dead or unconscious. Then the dancer picks up the boy's limp body and throws it over the fence, where two other dancers catch it. One of these puts the boy on his feet and tells him to run in a certain direction, while the other drops a heavy log on the ground to convince the boy's mother, waiting on the other side, that her son is dead.

Inside the Bush, the ceremony is opened by a rite calculated to inspire strict obedience in the boys. First, one of the officials shows the boys a tray of fingers and toes cut from sacrificial victims, and tells them that these were taken from boys that had peeked in earlier ceremonies, or who had scoffed. To make this even more impressive, the officials then grab one of the boys and accuse him of peeking or making fun of the Poro; they kill him at once in front of the other boys, cut him up and cook him, and all the company present, including the boys, eat. If they happen to

catch a woman peeking through the raffia fence, or inside the Bush, they kill and eat her also.

After this comes the rite of circumcision, during which the boys not only undergo this operation but are also given the dried clitorises cut from the girls at the last Sande school to eat. The girls are similarly given the boys' prepuces when the time comes. The most important rite, however, is that of scarification, which is supposed to represent the teeth of a supernatural crocodile which has swallowed the boys and spewed them out again. Any boy who fails to return home after the Poro is over, and who actually has been eaten, is said to have remained in the crocodile's belly.

Once the boys have been duly impressed by these rites, the process of instruction begins, and they learn the details of agriculture, trades, herb medicine, and the like. In the Bush, model gardens are planted, and forges and other experimental paraphernalia are set up. When the period of instruction is over, the boys are fattened for several weeks and washed very clean; then they are sent out into the outer world again, and they run about the village, pretending to be strangers and to know nobody. Their parents then find those who have survived the ordeal, which is the great majority, and the boys pretend not to recognize their parents. Finally, their parents take them home and the boys are thereafter free to marry, to adopt a trade, and to live in general as adults. Those who have been through special schools may go back several times for higher degrees and may thus become leaders in the activities of the community.

In this rather involved and lengthy ceremony, or sequence of ceremonies, it is easy to pick out the principal elements. The mock killing of the boy and tossing him over the fence is the rite of segregation, the scarification is, among other rites, a rite of transition, and the return of the boys, pretending not to know their parents, represents incorporation. After their emergence from the Bush, they have been thoroughly conditioned to a new set of relations and they can adjust themselves to their families on a new level without much difficulty.

The symbolization is not complicated on the whole. The raffia is supposed to represent rain, probably because it flutters and waves; the word Poro means earth. Thus the symbolism of the material of the fence and of the school itself is the fertilizing of the earth by natural forces, which is necessary for agriculture, which is the chief technique in which people interact with each other. The acting out of the killing at the beginning of the ceremony symbolizes the separation due to death, and killing is a dramatic form of separation. The scarification is a symbolic action which is part of the rite in which the masters of the Poro originate to the novices. The

killing of a fellow member not only serves to make them respond to the high rate of origins of the masters, but also symbolizes in the most dramatic possible way their authority, and the cannibalistic meal places them in the position of ritual antagonism to anyone who has put himself outside the system, thus building up their internal rate of interaction. The eating of the girls' clitorises symbolizes the origins of males to females in the family relationship, while in the Sande school, the girls return this. Needless to say, among these people neither the male nor the female set has a much higher frequency than the other.

III. CONCLUSION

In the Rites of Passage, which accompany a crisis in the existence of an individual or group, we have seen a characteristic order in the changes in the relations of the members of institutions. All these rites involve the acting out of new relationships, and the ritual which controls the interaction may be elaborate or it may be very brief. In every case, however, we have seen that Van Gennep's three stages have quantitative significance. *Separation* involves the marked decrease in the interaction rates of the individuals within the systems in which he ordinarily participates. *Transition* involves the increased interaction, often for a very long period of time, in the institution in which the individual is to interact. Where this involves entrance into a new institution, the transition period is clear-cut; but even where, as in the case of a death, the change in the individual's relations are confined within the limits of a single institution, there still is a separation from other relationships to be found, and interaction for a limited time between only the members of the institution, as for example among the Murngin. Finally, when the period of conditioning is over, and the frequency of events has been built up to a constant rate, *Incorporation* occurs, and the members of the group, including the individual or individuals directly affected by the crisis, begin to interact in their old systems of relations, but during this period, in which there is a basic redistribution of the interaction rates, the individual is regarded as being in an unstable condition.

Not only are these changes in interaction rates in the Rites of Passage carefully prescribed, but also they may be regarded as dependent upon the existing equilibrium of the society. For every institution, and also in the case of every Rite of Passage, there is considerable variation in the length of the free periods of adjustment and in the frequency of the interaction taking place within them. Where individuals are to occupy positions as leaders within a group, the length of the Rite of Passage is ordinarily greater,

and its elaborateness in symbolic context and in the number of relationships involved increases markedly. In some societies, for example, the marriage ceremony itself is of little importance, although the sequence of events leading up to the period at which the man and woman live together may have been an extended one. We saw among the Toda that there was no marriage ceremony proper, and this seems to be related to the fact that the betrothal ceremonies were conducted over a long period, from the time the two participants were very small until they began to live with each other. Among such groups as the Murngin and the Iroquois, a long series of ceremonies has to be undergone before members of the institution to which the deceased belonged are once more able to resume the normal course of life. In other groups, as among ourselves, a single ceremony may suffice.

It is important to realize that the elaborateness of these ceremonies is an expression of the relation of the group to other institutions in the society, and the degree of complexity of the ceremony varies both as a function of the position of the group in respect to other groups and also as a function of the quantitative value of the changes resulting from the particular crisis. In most societies, the ceremonies associated with birth are by comparison to other Rites of Passage of little importance. The birth of the son of a ruler, however, as in England, ancient China, and most of the Moslem countries, may involve quite elaborate celebrations.

Associated with these changes are the symbolic representations of necessary relationships. Wherever there is a transition between one group and another, the symbols employed dramatically represent the changes in the equilibrium between systems. The symbols which have a place in the interaction are those which refer to habitual interactions of the individual, either in the system in which he had previously interacted or those to which he is to be introduced in the new system. In general, the symbolic apparatus associated with the Rites of Passage is relatively meager, and it only reaches a considerable degree of elaboration when the individual is a member of several tangent systems. For this reason we cannot obtain a sufficiently clear picture of the use and significance of symbols in ceremonies until we consider the Rites of Intensification, where, as we shall now see, the necessity for maintaining or increasing the interaction rates within a single system, or in groups of tangent systems, involves the extensive employment of all the symbolic materials to which the individuals have been conditioned.

SUMMARY

Throughout life, each individual undergoes changes in his relations to others, and these changes will upset his own equilibrium and that of

others in the systems in which he interacts. These changes are caused by the non-periodic crises which are repetitive for the group but not, as a rule, in the case of the individual: i.e., by birth, puberty, illness, death, marriage, induction into a new institution, etc.

The first step in the restoration of equilibrium after such a crisis is often to perform a ceremony, known as a *Rite of Passage.* All such ceremonies consist of three parts—*separation, transition,* and *incorporation.* Each consists of a change in interaction rates, acted out in an habitual way; the first involves a marked reduction or cessation of interaction between the individual and the members of the group in which he has been interacting; the second is a period during which he interacts within the new system and becomes conditioned to his new rates, usually through isolation, training, and in many cases ordeals; the third involves a ceremony in which he resumes his interaction with the other members of his community, i.e., with both groups, but at his new rate of interaction.

For each crisis the ceremonies differ in complexity and in the number and types of relations involved. These differences depend on the magnitude of the changes, on the number of individuals and institutions affected, and on the degree to which they are affected as well. The death of a child makes less disturbance than that of an adult male in his prime, and is given much less in the way of ceremony. The death of a king affects many people and institutions and the resultant ceremonies are quantitatively great. In societies where the male set is quantitatively stronger in origins than the female, the birth, death, etc., of a male makes a much greater change in the equilibrium of the family or other institution and hence evokes a more elaborate Rite of Passage. Thus the elaboration of a given ceremony is a function of the quantitative value of the changes resulting from the crisis in question. The symbols which are used in the rites refer to the habitual interactions of the individuals concerned, either in the system which the individual or individuals undergoing the ceremony are leaving or that which they are entering.

CHAPTER 21

Rites of Intensification

I. INTRODUCTION

As we stated in the last chapter, the basic difference between a Rite of Passage and a Rite of Intensification is that the former restores equilibrium in a system after a crisis involving an individual while the latter restores equilibrium for the group after a disturbance affecting all or most of its members. It is with disturbances of this second kind that we shall now deal.

These group disturbances, as we saw in Chapter 18, are largely of an environmental character, and result from the alternation of day and night, the phases of the moon, or the progression of the seasons in their annual cycle. The great regularity of these changes gives their occurrence a constant rhythm, which is reflected by the changes in the interaction rates of the institutions affected by them. For instance, in an agricultural community in the middle latitudes, farmers cannot cultivate the soil in the wintertime. The institutions based on agriculture begin their annual round of interaction at the time of the spring plowing, and most of it comes to an end after they have harvested their crops in the fall.

During the agricultural season there will be rhythmic variations in this interaction, as people successively perform different techniques, some of which require more interaction than others. When people come together to practice a technique that requires a change in interaction, a Rite of Intensification will ordinarily occur. Some of the extensive Rites of Intensification, such as the harvest rites, mark the end of a period of technical activity, while others, like planting ceremonies, mark the beginning of such a period. The principal characteristics of these ceremonies is that they accompany a change in the interaction rate within an institution or group of institutions, and provide a dramatic representation of the habitual relationships of the individuals in the sets of which the system is composed.

This acting out of the ordered interaction of the members has the effect of reinforcing or intensifying their habitual relations, and thus serves to maintain their conditioned responses. That is why we have called them

Rites of Intensification. In the technical (physiological) sense, the performance of these rites prevents the extinction of habits (orders of action) to which the individual has been trained. We, therefore, find that the Rites of Intensification make up the great periodic ceremonies of a society, as well as the less spectacular daily, weekly, monthly, and yearly rituals which provide the framework within which the interaction of the institution is to a large extent ordered and controlled.

As the examples which follow will suggest, these periodic ceremonies have a wealth of symbolism associated with them. It can be shown that each symbol used refers to the contexts of the interactions of the celebrants in their institutions, and these are largely provided by their technology. The reason for this is that the mechanism of the conditioned response, through which symbols obtain their meaning, depends upon a regularity of repetition. The effectiveness of symbols selected from the regular interaction of members of institutions is, therefore, reinforced by the regular performance of the Rites of Intensification.

II. RITES OF INTENSIFICATION ASSOCIATED WITH SPECIFIC INSTITUTIONS

Family Ceremonies. Perhaps the simplest of all examples of Rites of Intensification are those associated with family meals. Let us suppose that it is six o'clock in a conservative American household. The members of the family have gathered together from their various activities and are awaiting dinner. Since most of them have not seen each other all day, their interaction rates increase rapidly as they tell each other what happened in school or in the shop or out in the fields. Some of the younger members may even pretend to strike each other and chase each other around the room.

The time now comes to eat. The members of the family file into the dining room, in an habitual order of march, with the older members of both sexes going first. As they sit down at the table in their regular places, some of them continue their conversations, but the father, sitting at the head of the table, clears his throat in warning, and the others fall silent and bow their heads as he begins to say grace, repeating an invariable formula which has been used in the family for years. After this brief ceremony, in which the father originates to the others, who respond by bowing their heads and perhaps in some instances by repeating "Amen," the meal begins, and the interaction follows a more or less regular pattern of high frequency.

In some families and under some conditions, the ritual of grace involves an extensive series of set events, and by watching carefully how this takes

place, one can see that this simple case illustrates not only the essential nature of the Rites of Intensification, but also the way in which they depend upon and reflect the type of equilibrium present in the family group. It will sometimes, for example, be observed that while the father usually says grace, the mother sometimes will do it, particularly when the family is alone. In many families when visitors are present or members of the extended kin who do not habitually eat there, one of them will be asked to lead the group. There is, moreover, much difference in the amount of interaction which takes place during such proceedings and in the length of the prayer. In some families, all of the members except the father sit silently with bowed heads; in others, a number of responses may be heard. These differences in the frequency of origins, in the matter of responses, and in the identity of the leaders must be considered if we are to understand the relations within the particular system.

Some Rites of Intensification take place within every family, even though they consist of no more than a single set event. Among the Omaha, for example, the grace ceremony is extremely simple. These people were accustomed to eat two meals a day. In each household the mother served the food at these meals to each of the other members of the family. After everyone had been served, the father made a food offering, by taking a small portion and dropping it into the fire in recognition of the relationship between food and the Great Spirit, Wakonda. After this ceremony everyone was at liberty to eat. Among the Omaha, as among practically every other people known, fire symbolized the habitual interactions of the family, since many family interactions take place around the hearth fire. As we shall see later, this simple ritual formed part of the general regulations governing the total interactions of the entire tribe. Wakonda was brought into it because he symbolized these interactions, and every Rite of Intensification which the Omaha conducted was associated with him, just as all Christian rites include some mention of God.

Among the Chukchi in northeastern Siberia, the fireboards, with which fire is made, are the most important family symbols. A fireboard is a flat piece of wood notched along the sides, and fire is made by rotating a wooden spindle in a socket cut at the peak of one of these notches. This board is so shaped that it has a human head carved at one end, and when all of the rest of the board has been used up in making fire, the head is cut off and put on a string with former heads, to constitute the symbols of family.

Now the principal activity among the Reindeer Chukchi is tending their herds, and each family owns a herd of its own, which it is the concern

of the family members to look after. During the summertime the younger people take the reindeer down to the tundrā on the edge of the Polar Sea to feed on the rich moss, while the older people stay near the edge of the forest. This gives the young people a chance to interact at a relatively high frequency with others of their own age from other camps, and hence, when the time comes to split up and rejoin their parents at the forest's edge, a change occurs in their system of interactions. At the time when the families are reunited, therefore, and are ready to take their herds back into the mountains for their winter pasturing, the members of each camp celebrates what is known as the annual Hearth Ceremony.

First they light a large fire from coals ignited by the fireboard and drill, and then the members of the family pick embers out of the fire and throw them at the reindeer, driving the deer through the smoke. This simple Rite of Intensification consists of linking the technique of fire-making, upon which every family depends and which provides the fire which forms the principal context of their interaction while they are indoors, and the technique of reindeer herding, which is their principal means of maintaining interaction while outdoors. This Hearth Ceremony, therefore, depends for its symbolization upon the two principal techniques associated with the family: fire-making and reindeer herding. So closely are these linked that the Chukchi call the fireboard the "reindeer-fire-tool," and when a new one is made, they kill a reindeer and smear its blood on the board. Each fireboard represents the ownership of the herd, and they mark it with the same design with which they mark the reindeer. The string of fireboards will belong to the principal heir, who will become head of the camp and owner of the herd.

Ceremonies of Extended Families. Extended family groups, such as clans, phratries, and the like, usually have Rites of Intensification of their own, but these often take the form of national or tribal rites, where the extended family is in itself a sovereign state, and these will be described later.

One of the most famous examples of an extended family ceremony is the Witchetty Grub Rite practiced by a moiety of the Aranda tribe of Central Australia, and described in the classic work of Spencer and Gillen.[1] In the performance of this rite, men of the Witchetty Grub totem go up to Emily Gap, led by an old man who is the head of the totem group. They carry branches of the bush on which the grub feeds. At the sacred place there are stone cliffs painted with sacred symbols. There is a cave in these

[1] Spencer, Sir B., and Gillen, F. J., *The Native Tribes of Central Australia,* London, 1899.

cliffs, into which they all go; in the floor is a large stone representing the adult grub, surrounded by small stones called *churinga unchina,* which represent its eggs, or its chrysalis form. The men stroke the big stone with their branches, thus performing the action of offering it food, and the head man picks up one of the small stones and strikes each man in the stomach with it, saying, "You have eaten well."

After this, the men pick up the small stones and walk back to the camp, following the route which they believe their ancestors followed in mythical times when they walked through the countryside arranging the landscape. On the way to camp the men place the small stones in shallow holes in the ground, dug to represent hatching places. Outside the camp, they paint themselves in their traditional Witchetty Grub pattern, put on symbolic regalia, and then enter. Meanwhile an old man has built a long narrow brush hut, to represent the chrysalis case of a witchetty grub. The members then enter this, singing of the grub in its various stages as they march, shuffling in and out in line a number of times. Meanwhile other people bring them food and water, and they sit outside the hut all night singing. In the morning, they take off their regalia and hand it over to the members of the other moiety, who have charge of it.

When the grub is ready to eat, everyone collects large supplies. The Witchetty Grub men eat a little, to start the action going, and then the members of the other moiety eat the rest. After this, the Witchetty Grub people can eat a little of this food as long as the season lasts, but very little, since they believe that otherwise they would not be able to perform the ceremony.

The witchetty grub is one of the seasonal windfalls in the life of a subsistence food-gathering people living in an adverse environment. When it comes, it comes in great numbers, and everyone goes out to collect these larvae. Thus there is a marked and abrupt change in the activities of the people, in terms of the appearance of this insect. In this rite of intensification, one section of the group acts out the whole cycle of the witchetty grub in its relation to men, as they have observed it. They feed the grub, they take its eggs and set them in hatching places, and they fill their stomachs with it symbolically. Back at camp, they sing about the grub and bring it out of its chrysalis mimetically.

Overtly, through the rationalization of the Australian in explaining it to the anthropologists, this ceremony serves the purpose of making the grub go through its annual cycle so that it will be plentiful and people can eat it. The symbolism is so simple and clear that it needs no explanation and is apparent to the natives themselves. From the analytical standpoint,

this ceremony brings about an increase in the interaction rate of the people and prepares them for a new activity which will involve different relations from those they had before; in the ceremony a leader originates to a company of followers, who in turn originate to the rest of the tribe, that is, the other moiety. When the grubs have been gathered, the members of the company also originate again in their ritual, eating of the first fruits, so to speak, and this insures an orderly interaction in terms of eating. They cannot eat much of it, however, because of an antagonism of symbols, since they identify themselves with the grub.

Ceremonies of Political Institutions. Rites of Intensification are very commonly associated with political institutions. Although we shall save the great ceremonies which serve to intensify interaction at national festivals until later, two examples may be given here in which we find people acting out the order of interaction in the hierarchy of the institution, under the leadership of its head.

Malinowski has recorded a text from a Trobriand Island ceremony in which the chief allots the tribal garden plots at the beginning of each planting season. As the following quotation will illustrate, parts of this ceremony are extremely simple, forming merely a sequence of set events.[2]

> Chief: "Who will make the plot at the stile?"
> His Son: "I."
> Chief: "And the next one?"
> After three or four plots had been enumerated seriatim, the chief continued:
> Chief: "Good, Let us proceed to the mangrove swamp. Who will follow?"
> Certain Commoners: "I . . ." (claiming successively the plots adjacent to the swamp).
> Chief: "Already we have arrived at the garden corner. Who will make his plot around the garden corner?"
> A Commoner: "I."
> Chief: "Who will take over the plot at the garden side?"
> Certain Commoners: "I."
> Chief: "And the corner which returns from Swadela?"
> A Commoner: "I."
> Chief: "Who will garden the plot named Ogayzsu?"
> A Commoner: "I."

Among the Inca of Peru, the beginning of cultivation was marked by a ceremony in which the Inca first hoed a plot of ground, then he stopped and the next highest official hoed in turn, and so on down the line.

[2] Malinowski, B., *Coral Gardens and Their Magic*, London, 1925, George Allen and Unwin, Vol. I, pp. 127-128.

origins of action from the top of an administrative set to the bottom, as shown in the Peruvian example, and to build up interaction in a new set, as in that from Ecuador, but also to stabilize the ordered relations between the members of the various segments or departments of the organization, when such segments or departments occur.

Among the Omaha, the war parties which went out to fight other tribes each summer were under the control of four officials called the Keepers of the Packs Sacred to War. Each of these men had charge of a Sacred Bundle, or Pack, containing relics of a highly symbolic character, and each pack itself served as a symbol of the relations of the people to each other in times of war. These particular packs contained dried birds. The Keepers were not themselves members of warrior organizations, but represented the civil rather than military branch of the political hierarchy, just as the Secretary of the Navy and the Secretary of War in the United States Government are civilians.

After the war season was over and the warriors had returned, a ceremony was held in which the Keepers of the Packs Sacred to War stood behind the packs, facing east, and the warriors stood in a line facing them. Each warrior held in his hand a stick which had been painted red, and which symbolized the war honor which he was to claim. The Keeper of each pack told the men whom he had sent to war under the authority of his pack to speak the truth, or the birds inside the War Pack would hear them and would report their lying words to Thunder, the War God. Then he signaled each man in turn to step up and claim his deed. First, however, the warrior had to drop his stick on the Pack. If the stick stayed on the Pack, he was considered to be telling the truth; if it fell off he was not allowed to make his claim.

Three symbolic elements are associated with the set events making up this ceremony:

1. The Red Sticks. The sticks themselves symbolize arrows, the red paint, life and blood. The connection of the arrow and the color red in the sequence of activities which took place on the warpath are self-explanatory.

2. The Birds Inside the Sacred War Pack. These birds are associated with storms and with the appearance of carrion-eating birds on the battlefield, hovering over the dead.

3. Thunder, the War God, was the principal symbol of all warlike activities among the Omaha as among many other people in different parts of the world. In the first place, lightning kills people. In the second, war parties were generally held during the summer months, which is a period of violent thunderstorms in the Great Plains. In the third place, thunder

and lightning constitute the most arresting and impressive of all the elements in the context of war.

This association of thunder with warfare was enhanced by the initiation ceremonies of boys, who were dedicated to thunder by having a lock of hair cut from the head of each one and placed in a Sacred Pack, where these symbols were kept. This initiation ceremony was held in the spring, after the first thunder of the year had been heard, and the lock which was taken from the boy's head stood for the scalp-lock which every warrior wore when he reached puberty.

Ceremonies of Religious Institutions. The majority of all the events which take place within religious institutions occur in Rites of Intensification, since these rites are the principal means by which equilibrium is maintained (actually it is restored as the result of periodic changes) in the group which makes up a religious system. In the United States and other Christian countries, the principal rites are the weekly church services, in which the members of the congregation respond to the origins of the minister or priest, in terms of a formal order of set events. Differences in these weekly crises are met by changes in the length of various parts of the service, an Easter hymn may be sung or the length of the sermon may be increased. Within this cycle of weekly ceremonies, the ritual changes from time to time as annual changes in the interaction rates occur, and we find special seasonal festivals, such as Easter and Christmas, made the occasion for special services.

Frazer and others have pointed out long since that the ceremonial calendar of the Christian Church is based upon the annual changes in the agricultural activities in the Mediterranean countries, which in turn reflect the seasonal changes in the Mediterranean climate, as discussed in Chapter 5. Christmas, for example, corresponds to the winter solstice period, in which agricultural work is at a minimum, food is still plentiful, and there is no technological framework of activities to order interaction, as there is during other seasons.

Christmas is essentially a family rite. The burning of the yule log, the use of mistletoe as an excuse for kissing, the great feast with a turkey, goose, boar's head, or whatever, and special puddings, and the giving of gifts between members of a family all serve to raise the interaction rate within the family to its highest level of intensity reached during the annual cycle. Preparations go on for weeks in advance, and on Christmas Day everyone stays home and interacts in the family circle, while activities in most other institutions cease for the holiday season. During the course of the rite the relationships within the family are acted out; at the feast, the

father carves the roast and distributes the meat, which is the most important part of the meal; the mother may help in serving gravy or pudding. The night before Christmas, the children hang their stockings in front of the fireplace, which is the symbol of the family relationship; when the gifts are handed out at the tree in the morning, it is the father who reads the names on the presents and hands them to the others. Usually the servants are brought in at this time, and also given presents. They often make gifts to the children, but not as a rule to the heads of the family, the father and mother.

The reason why Christmas serves as a Rite of Intensification for the family is that it marks the beginning of the winter season, during which people in the simpler communities cease most of their work out-of-doors and sit around in their houses repairing their equipment and doing minor jobs of processing and manufacturing. The winter is the time when most interaction is carried on within the family, and Christmas prepares them for this change. This rite is celebrated both in the family and in the religious institution, the Christian Church. It is not always a religious rite, however, since we observe that people who never go to church and are members of no religious institution regularly celebrate Christmas.

Christmas is as valid from the standpoint of climate and technology in Northern Europe and America as in the Mediterranean, if not more so; its celebration has taken over even more of a family character in the North than in the southern countries where the winter is milder and the change in interaction less dramatic.

At the end of the winter season comes another change, when people begin to go out-of-doors more often and start their annual agricultural activities; when fishermen put their boats in the water, and part-time craftsmen sell the goods they have made in the winter. This marks a diminution in the interaction within families, and an increase in other institutions. In Mediterranean countries, where the transition from winter to spring is an abrupt one, a ceremony of great intensity is held at this time. This ceremony is Carnival, which takes place during the last three days and nights before Lent, and has thus been linked to the Church calendar.

During Carnival, people interact with each other at a very high rate, dancing in the streets, throwing confetti and squirting perfume at each other, parading about in companies to music, dressing up in bizarre costumes, and in many cases wearing masks. As anyone who has lived through carnival time in a Mediterranean country knows, people reduce their interaction in other institutions at this time to originate to each other freely; everyone speaks to everyone else, whether they know them or not, and par-

ticularly if they do not. The use of masks makes this high rate of interaction easier, and people dance and carry on conversations and make love to each other very often in a state of anonymity.

This ceremony, like Christmas, is part of the Church calendar, but there is little else to link it to the religious institution, since priests as a rule are conspicuously absent, and individuals who belong to no church take part in it as well as the church members. It has not been carried to the northern countries, where spring comes more gradually and some three months later. Instead we have at this time its feeble counterpart, St. Valentine's Day, on which children send each other pretty cards. These missives, borne often by postmen wading through snowdrifts, serve as a simple Rite of Intensification in which the children originate to each other without the implication of betrothal which the symbols on them would connote in Mediterranean countries.

Rites which are confined to religious institutions alone are those which recur in a briefer cycle, like weekly meetings. This is true outside Christianity as well as within it. In Dahomey, for example, a member of a Vodu cult, who as we mentioned goes through a long period of initiation in order to join, behaves in much the same manner as members of churches with which we are more familiar. Every Vodunsi, or member of a cult, worships the deity of his cult only on its sacred day of the five-day week, and on that day he does no work. Since the different deities have different days, each day some people are working while others do not. This situation is like that in North African towns where the Moslem shops are closed on Friday, the Jewish on Saturday, and the Christian on Sunday. It indicates that the various institutions within the society are not linked into as complex a system of interaction as in our civilization, where the Jews as well as the Christians keep their shops closed on Sundays only. One might also compare the situation in India, where members of different religious systems, as well as different castes, wear different symbols on their foreheads, or different types of clothing, with that in America, where everyone wears the same kind of garments under ordinary circumstances.

Returning to the Dahomean devotee, we find that besides keeping his weekly day of devotion, he works at other times for stated periods for the priests, to provide food for the maintenance of the temple, and once a year he will bring them sacrifices. On the days of worship he goes to the temple and dances the rituals of his group, which involve an elaborate sequence of activities, and which, as we have seen, required seven months of initiation to learn.

The question may arise as to why the usual cycles of activity in religious

institutions take seven or five days, or some such number. In the case of seven, we know that this represents one-fourth of a lunar cycle, while five is the number of fingers on a hand, the primary unit of counting among most peoples, along with ten, or "two hands," and in some cases twenty, representing the totality of digits. Whatever the symbolic connotation of these numbers, the underlying reason why the interval between the most important rites of religious institutions is approximately so limited is that people interacting with each other in other institutions build up minor conflict situations which after several days may become serious. If the ceremonies were more frequent than this, some of them would be unnecessary, since equilibrium was not disturbed. If less frequent, the conflicts might become too serious to be taken care of by this kind of rite.

Ceremonies Associated with Economic Institutions. We are all familiar with the Rites of Intensification associated with economic institutions in our own country. These include company outings or banquets, at which the president of the organization makes a speech of welcome to all the workers, and various subsidiary officers in turn make addresses in the order of their position in the hierarchy. Organized contests are held between members of the various departments and the activities are usually terminated by a great banquet which all the members of the institution attend. These ceremonial activities of economic institutions may occur on special days, developed from the changing history of the company, or they may be associated with festivals such as Thanksgiving Day and Christmas, which are celebrated by all the institutions in the society. They also include the more spectacular ceremonies concerned with public utilities, like the famous rite in which the president of a railroad company drives a golden spike in the last tie of the track. In recent years, ritual has been increasingly employed in the activities of the Commercial, or Trader-Customer, set, through the medium of advertising. Every time we turn on the radio we hear someone singing a song about the merits of a Five-Cent Cigar, or Somebody's Codfish, and children are offered all sorts of insignia and membership in various clubs if they will get their mothers to buy twenty boxes of Crunchy-Munchy Flakes. Every time we pick up a magazine we see specimens of art captioned by the name of a cigarette, and every time we drive into a filling station we are greeted with ritual flourishes and speeches by symbolically garbed attendants.

In most of the "primitive" societies, the bulk of the rites are connected with the change in interaction rates of a craftsman when he starts his technical activity. He is, as a rule, leaving his family for an economic system, and the new rate must be symbolically represented and established. Among

the Nootka of Vancouver Island, for example, professional whale-harpooners went to the woods together and secluded themselves, and there they prayed and fasted for some time, and acted out the whole technical sequence of activity in the hunting and beaching of whales.

Rites of Intensification and Associations. Some of the most elaborate Rites of Intensification are those performed by members of associations, which is to be expected in view of the fact that associations are formed purely by the need of individuals for adjustment which they cannot obtain in other institutions. In our own society, where associations have reached their acme in numbers and complexity, the most colorful ritual of all is to be found within them, since it is the associations that provide the means for adjustment more than any other institution.

For an example in a simpler society, let us turn to the Hethuska, the warrior society of the Omaha, which has been previously mentioned. The meetings of this society took place once a month, and much of the interaction consisted of singing and dancing. The leader of the society, who had to be a man who had won one of the highest war honors, sat in the middle of the rear of a lodge, opposite the door. The other warriors sat around the walls of the lodge on both sides, arranged according to their grades of honor.

No clothing was worn except the breech-clout and a long bunch of grass representing scalps. Each man was painted to represent the type of war honors he had won. The ceremony began when the leader picked up a bowl of black paint; the members then sang a song in which Thunder was pictured as leading the warriors into battle—all of them decked out in black paint. Then each member took black paint from the bowl as it was passed to him and painted himself in turn. After this, the leader took the pipes of the society, pointed them in the cardinal directions, lit them, and handed them to the servants to pass around, and each warrior smoked in turn. Following this, a number of songs and war dances were performed by the members. Then came a feast which was served in a prescribed way. The leader made an address on the importance of food and expressed his gratitude to the giver of the feast, and after everyone had eaten, the song of dismissal was sung, the members marched around the lodge, and the meeting was over.

The meetings of this society consisted of an acting out of the regular interaction of the members, under the leadership of the head of the society, in which each member interacted in contexts which were made up of the symbols connected with war. The men were dressed as they would be on the warpath, and were painted with the black paint habitually used at that

time, and their songs and dances consisted of descriptions of what happened in war. The effect of these symbols was to recall to the individual his past interactions on the battlefield, and the symbols were, therefore, derived from the tangent relations upon which the association was based. The symbols, therefore, served to emphasize the habitual relations between the two systems, and by their definition, and the exclusion of other symbols not associated with war, to reinforce the habitual interaction with which the symbols were associated.

III. GREAT TRIBAL OR NATIONAL CEREMONIES

Introduction. From what has gone before it is apparent that it is the lesser Rites of Intensification which are confined to a single institution. These rites become greater in amount and intensity of interaction and in the number of individuals involved as they include more and more members of tangent institutions which have developed a constant rate of interaction.

In the great annual crises which affect everyone alike, it is only to be expected that the accompanying Rites of Intensification will not be limited to a single institution. That is why, as we have already seen, such ceremonies as Christmas and Carnival cannot be kept entirely within the jurisdiction of the church, since everyone will celebrate them no matter whether they are church members or not, and in time of national crisis due to war or threats of war everyone is also included.

These ceremonies are the great tribal or national ceremonies of a people. It would be easy to give examples of these from our own society. We might cite Memorial Day with its parade of veterans to the cemetery to decorate the graves of those fallen in the nation's wars, its music and flowers; with the pilgrimages of the people in general to decorate their family graves; with the speeches of the old soldiers to the public school children, recounting their deeds on the battlefield; and with the observance of the elaborate ceremonial of the flag.

We might cite the Fourth of July, and particularly the Fourth of July, 1941, when on one radio program Franklin Roosevelt spoke, quoting from the Declaration of Independence and calling upon every American to be prepared to lay down his life for his country; when Chief Justice Stone led the nation in pledging allegiance to the flag, and the national anthem was sung. On this as on other Fourths, Americans fired off firecrackers and went at night to the public commons or ball fields of the towns and cities to watch the fireworks, which usually ended with a set piece representing the American flag, and again the national anthem.

We will leave to the reader the elaboration and interpretation of these

ceremonies which are so important for the regulation of interaction in our nation, in order to give in detail an account of a sequence of rituals which made up the annual tribal ceremonies of a more primitive people, and to analyze the symbolic elements in them. As we shall see in this account, the interrelations between different systems in the society are acted out by their members to reinforce the habitual relations of individuals within systems, and also between systems. We have chosen for this purpose the principal ceremonies of the Omaha which are performed at the conclusion of their fourth and last annual buffalo hunt, which marks the high point, from the standpoint of interaction, of the year, and precedes their dispersal in smaller units for the winter.

In these ceremonies, it will be clear not only how segments of systems are related to one another, but also how the symbols which have significance in the various institutions among the Omaha play a systematic part in the context associated with the interaction. We select the Omaha for discussion, not only because of the excellence of Fletcher and La Flesche's description of the symbolism (La Flesche was the son of the Head Chief of the Omaha), but also because the reader is already relatively familiar with the institutions of the Omaha, which we have used as one of our main sources of illustrative material.

The Omaha, End of the Hunting Season. As already mentioned in Chapter 18, the Fourth Tribal Surround is followed by the ceremony of Anointing the Sacred Pole, and then by a ceremony called "The Hedewachi." For some time during the tribal hunt, the Omaha have been on the march, living in tipis and camping at night in the ceremonial arrangement of tipis by gentes and sub-gentes, called the "Huthuga," or camp circle. As we have already pointed out, every family's position in the camp circle was fixed by tradition, and this brought about the habitual interaction of members of neighboring gentes. Moreover, during the period that the tribe was on the march, the members of the family marched together and were associated in the daily routines involved in setting up and taking down the tipis and packing and unpacking their belongings. When the buffalo were encountered, the hierarchical organization of the tribe came into action, and every man took part in definite and prescribed ways, depending upon his position as Leader of the Hunt, soldier, hunter, or cutter of meat.

The Ceremony of the Sacred White Buffalo Hide. After each of the four Surrounds, a ceremony of the Sacred White Buffalo Hide was held, which involved the hereditary Leader of the Buffalo Hunt, the Seven Peace Chiefs, the Keeper of the Sacred Hide, and sometimes a few of the Nikagahi Xude, or appointive chiefs. The ritual which took place at this cere-

mony was considered to be very sacred, but nevertheless was simple and easy to understand. Twenty tongues and hearts had been taken from the buffalo killed that day, and the attendants at the feast ate their food sitting in a crouching position, wearing their buffalo robes, with the hair outside, a robe which still had the head and tail. After the feast the ritual of the White Buffalo Hide was sung. This ritual described the origin of the buffalo under Wakonda, and then went on to a detailed description of all the events which took place from the beginning of the time the tribe went on the march to the final kill and the Sacred Feast. During the singing of these ritual songs the participants passed the special pipe, sacred to the hide, around the company and all smoked it.

The Sacred Pole Ceremony. After the fourth of these ceremonies had been completed, the Keeper of the Sacred Pole called the Seven Peace Chiefs to the Sacred Tent where the Pole was kept. There they took part in a feast similar to that just described, which formed the first part of the White Buffalo Hide Ceremony. At this meeting each chief took a reed from the bundle kept in the Sacred Tent, which constituted the tally of the men of the tribe, and named a warrior. After a sufficient number had been chosen, the Keeper of the Sacred Pole gave these reeds to the Tribal Herald, to give to each man as named. Each warrior, when he received his reed, returned it to the Keeper, and then went to one or more lodges of the tribe and selected a pole to be used in constructing a lodge for the ceremony. Thus a single pole from every lodge in the tribe was used in the construction of the Ceremonial Lodge, which was therefore considered to be holy, or sacred.

In this early part of the ceremony, therefore, we see a sequence of events which take their order of action from Chiefs to Keeper to Herald to warriors, and from warriors to the members of each family in the tribe.

After this, the ceremony proper began. First the Keeper summoned the Seven Chiefs and the Xude (appointive chiefs) of all the gentes, who then went to the Ceremonial Tent wearing their buffalo robes in the ritual fashion. Then the wife of the Keeper carried the Sacred Pole to the edge of the Ceremonial Lodge, where the Keeper arranged it in place. A pipe belonging to the Sacred Pole was then smoked, and the bundle of reeds was brought out, and the Chiefs mentioned the names of all the householders in turn, after which the Tribal Herald repeated them. Each man mentioned was supposed to send one of his children to the Ceremonial Tent with the cut of the buffalo called the Tezhu, which we have mentioned earlier. After this had been done, the Keeper cut in the ground in front of the

Pole a circular figure called Uzhinete, the significance of which we will discuss shortly. This completed the first day of the ceremony.

During the first day the ceremonial activities were very simple and involved little abstruse symbolism. They were made up of two sequences of events. In the first the warriors are selected, and they in turn select a pole from every lodge, and the Ceremonial Lodge is constructed by members of the gens of the Keeper of the Sacred Pole. Then the Keeper summons the Nikagahi Shabe (the Seven Peace Chiefs) and the Nikagahi Xude (the appointive chiefs) to the lodge, after which there are several events between the Keeper and his wife, involving setting up the Pole. In the second sequence of events, the Seven Peace Chiefs originate action through the Tribal Herald to heads of families. Thus, up to this point, there are no events in which Chiefs and Keepers originate action for all members of the tribe.

On the second day, the Keeper of the Pole and his wife together painted the Pole with red ocher, and almost all the interaction which took place was between them. In the first stage of the ceremony it will be remembered that the ritual songs described the Pole as symbolizing the unity of the tribe, the unity of the Council of Seven Chiefs, and the authority of the Thunder. The Keeper now arranged the best Tezhu pieces of meat on the ground in front of the Pole to symbolize the four Surrounds and the four repetitions of the Sacred White Buffalo Hide Ceremony. In the Sacred Pole Ceremony as a whole, it should be stated, almost all of the ritual actions were performed four times each. After arranging the meat, the Keeper cut the fat from the Tezhus into a wooden bowl held by his wife. This was then made into a paste with the red paint. During this time the pipe was being ceremonially smoked in turn by the Nikagahi Shabe and Nikagahi Xude. The Keeper then approached the Pole, holding a brush in his hand, and his wife held out the bowl, and in a highly stylized sequence of actions, the Keeper painted the Pole with a mixture of fat, which symbolized abundance, and red paint, which symbolized life. The act of anointing the Pole stood for the relation of Wakonda to the people in giving buffalo to them.

After the Pole had been anointed, the ceremonial sequence changed. The wife of the Keeper now originated the action. This involved the use of the Uzhinete, which we mentioned above. This was a circular figure with an opening toward the east, which represented the tipi, the family dwelling; and the huthuga, the dwelling of the tribe. In the center of the figure, where the fireplace would be in the lodge, a buffalo chip was placed and set on fire, and sweet grass used in sacred ceremonies and sprays of cedar, sacred

to Thunder, were laid on it. Also the seven arrows which belonged to the Pole, and which represented the Seven Chiefs as well as the weapons used in hunting the buffalo, were passed through it. Finally the Keeper's wife thrust the arrows through the basket-work which formed part of the decoration of the Pole, and if they went all the way through it was taken as a sign of good luck and all the members of the tribe cheered. In the last stage in the ceremony, the young men mounted on horses charged on the camp, symbolizing the charging enemy, and then all men who had won honors in defensive warfare acted out their war experiences, and this concluded the ceremony.

The Hedewachi Ceremony. Next after the ritual of the Sacred Pole came the Hedewachi Ceremony, which was conducted by the members of the gens whose totem was the red ear of corn and who had charge of distributing the Sacred Corn to every family in the spring before planting time. This ceremony provided any man the opportunity to give the presents called Wathinethe to the Seven Peace Chiefs which enabled him to get into the rank of Nikagahi Xude. A man who wished to give the first gifts which were needed to start the ceremony, and to keep the count of these presents as they came in, went to the Keepers of the Red Ear of Corn and asked them to perform the ceremony.

That evening a man of their gens who had won many war honors was selected to pick out a cottonwood tree, which he struck as if it were an enemy. When he returned and announced this, the Keepers arose, put on their robes in the ceremonial manner and announced the date of the ceremony to the tribe. They were accompanied by a woman of their gens who wore the tattooed mark of honor, which showed that her father was a member of the Night Blessed, or Honhewachi Society, which was mentioned in Chapter 17, and membership in which depended upon having given one hundred Wathinethe. For three days before this ceremony men who wished to make gifts to be counted for membership prepared them. Much of the excitement of the ceremony was derived from this procedure.

Meanwhile a number of willow wands, one for every member of the tribe, were prepared by painting the ends red. This was done as follows: First, the young men of the Red Corn gens prepared a number of such wands and then the Keepers of the Red Ear distributed them to the leading men of each gens in the tribe, who belonged to the Nikagahi Xude. After receiving the wands, these men sent all the other members of their gentes out to cut and prepare similar wands. In the meantime the members of the Red Ear gens organized a war party, sending out scouts and warriors who advanced upon a cottonwood tree especially chosen for the cere-

mony and attacked it. The tattooed woman already mentioned took four strokes, and then the young men cut it down. The fall of the tree was supposed to symbolize the fall of a warrior struck down by Thunder.

The tree was stripped of bark and leaves and carried back to the camp. It was then painted with alternate stripes of red and black paint which symbolized night and day, earth and sky, life and death. The Pole was then set up after swan's down and tobacco had been put in the post hole, and the symbolic figure, the broken circle, was cut in front of the Pole. These preparatory ceremonies lasted three days, and each of the acts which we have described was usually performed four times, just as in the Sacred Pole Ceremony. Many of the songs were repeated not only four but multiples of four times.

On the fourth day, all the members of the tribe participated in the ceremony. All the men were painted with their war honors, and the women and children were dressed in their best clothes. The entire tribe lined up in a circle by gentes, the men and boys in front, forming an inner ring, and the women and girls behind them, each person holding his willow wand. The sacred tribal pipes were held on high, and the singers of the ritual song of the ceremony began with the first of a sequence. At its conclusion, the warriors who had charged the tree sounded the war cry, and all the people shouted in response and waved their wands. Then the bearers of the sacred tribal pipes moved toward the Pole, and all the people followed. After four such movements, the men moved clockwise and the women counter-clockwise, so that the whole tribe was going in two concentric circles. During this song and dance, each time a man made a gift the dance stopped while the gift was proclaimed, and this alternate starting and stopping continued until the gifts had all been made and all the songs sung. At the end of the ceremony, with the concluding song, everyone threw his willow wand at the foot of the Pole.

Interpretation of the Sacred Pole and the Hedewachi Ceremonies. In each of these two ceremonies we see a systematic elaboration of set events and pair events, in association with symbols which are derived from the most important techniques practiced by the members of the tribe, and the ones which provide the most interaction. In the Ceremony of the Sacred Pole, the Pole itself symbolizes two different but associated institutions: the first, the political hierarchy and its direction of tribal affairs, including the buffalo hunt; and the second, the family. Among a tipi-dwelling people, the lodge pole is one of the most constant elements in the context of situation of the habitual interactions of the individuals. Through the repetition of events in which it is used, it symbolizes not only the individual lodge,

but also the organization of lodges which make up the tribal circle, or huthuga. The prayer symbol, uzhineti, which is a broken circle cut in the ground, has the same referent, the individual dwelling and the camp circle, and it is not surprising to find these motifs continually reappearing in such contexts. The Pole, furthermore, symbolizes not only the family and tribal organization of the people, but it is also associated with set events in which the Seven Peace Chiefs originate to the members of the tribe. This will be made particularly clear when it is remembered that only on a tribal march is the camp arranged in the form of a huthuga, and only then do the individual families live in tipis, while at this time the selection of camps and the direction of behavior are very completely controlled by the Chiefs, the Leader of the Buffalo Hunt, and the soldiers.

The rest of the Ceremony of the Sacred Pole represents a sequence of symbolic activities whose referents in interaction are quite clear. The part played by the buffalo robes, the Tezhu, and the fat painted on the Pole as symbols of the interactions of the tribe during the buffalo hunt, requires no elucidation. In the same way, the activities of the Keeper's wife symbolizes the part played by man and wife in the individual household, and the symbols used represent the two tangent systems, the political and the family, in the interactions of the members of the tribe. Finally, the part played by the warriors in defending the tribe from the enemies is acted out, and this enables these men to originate to the members of the group, thus maintaining their position in respect to other individuals in the tribe.

This later situation is, of course, even more completely symbolized in the Hedewachi Ceremony. Here three systems are interrelated: first, the political system, which is symbolized by the sacred tribal pipes; second, the clan system, which appears both in the preparations for the ceremony when the painted wands are given to the leading men of each gens; and also when, on the final day of the ceremony, the members of the tribe line up by gentes. The third system which is explicitly represented is the Honhewachi, or Night Blessed Society, not only by the part played by the tattooed woman, but also by the fact that members of the tribe who hope to join this society make their ritual gifts at this time.

In this ceremony, too, as in that of the Sacred Pole, the relations of warriors to one another and to members of the tribe are also acted out, and the central symbol in this ceremony, the cottonwood tree, was primarily a symbol of Thunder because of its use in war. After the Pole was attacked according to the sequence of activities used in war parties, it was decorated with the symbols of life and death. The black paint used by warriors to symbolize death and the red paint, which is the symbol of life, are used

not only in the Sacred Pole Ceremony but also in countless other contexts in which an increase of interaction is represented. Moreover, on the top of the Pole, a black covering was put to represent the scalp-lock of the enemy.

In this ceremony, as in the preceding one, the circular figure called uzhineti was cut in the ground to symbolize the household and the tribal camp, and into the post-hole for the Sacred Pole was placed a bit of tobacco, which symbolized Wakonda through its use in sacred pipes. These pipes, in turn, were associated with prescribed interaction in any important affair, whether in the meeting of secret societies or in the Council of Seven, or in the deliberations associated with ceremonial occasions, since they were smoked in all of these. The down of a swan, which is a water bird, was used to symbolize the relationship between heaven and earth which is provided by water. It should also be pointed out that the colors red and black, which symbolized life and death, earth and sky, are also associated with the two moieties in which the tribe was divided, one of which was the earth moiety and the other the sky. Moreover, the tree and its branches, in the shape of wands held by each member of the tribe, symbolically expressed the union of the members of the tribe when the branches were thrown at the foot of the Pole. All these symbols, in fact, can very easily be associated with habitual interactions of the individual, and they bear out the point that the Rites of Intensification not only involve prescribed interactions of individuals, but also employ symbols selected from a context of these interactions.

In each of these rites the emphasis, for the Omaha themselves, was upon its sacred characteristics. They believed that every detail of these rites was prescribed by Wakonda, the name used for supernatural power. It is quite clear that this symbol had strong emotional significance for the members of the tribe, and it will be remembered from our discussion of the process of symbolization that this emotional content is based not only upon the use of symbols which are associated with interactions of high frequency, but also on the actual participation of the individuals concerned in ceremonial interactions similar to those which occur within the several institutions in the society.

Thus, as we have pointed out before, the Rites of Intensification are ways in which, with regular periodicity, the system of relations in a society are regularly reinforced consequent upon the regular changes in the interaction rates, and this reinforcement applies not only to the interaction but also to the symbols which are associated with them. In the next two chapters we shall consider in more detail how the ritual activities which can be

considered to have supernatural force are derived from the context of the interactions of individuals in institutions, and we shall then see how the forms of representation of these powers is similarly dependent upon the way in which people interact.

SUMMARY

A Rite of Intensification is a ceremony in which equilibrium is restored after a crisis affecting a group, whereas a Rite of Passage restores it after a disturbance which directly affects an individual or class of individuals. The group disturbances which evoke rites of intensification are largely of an environmental character, resulting from the alternation of day and night, the phases of the moon, or the progress of the seasons in their annual cycle.

These changes recur ordinarily with a rhythmic regularity, and the changes in activities and in interaction rates which result are likewise rhythmic. A rite of intensification, such as a harvest ceremony, conditions the people to the new relations to follow by building up interaction in habitual channels to a high pitch of intensity, through the use of a wealth of symbolism. Each symbol used refers to the context of situation of the interaction of the celebrants in terms of their technology. The reason for this is that the mechanism of the conditioned response, through which the symbols obtain their meaning, depends on a regularity of repetition.

There are rites of intensification associated with each kind of institution. These include family rites, such as grace before meals; political rites, like the launching of a battleship; economic rites, as when the president of a railroad drives a golden spike; religious rites, familiar to everyone; and associational rites as celebrated in lodge conventions. The most extensive of these rites, however, are the great tribal or national ceremonies, such as that held by the Omaha at the end of their annual buffalo hunt before they dispersed in small groups for the winter, and our own Thanksgiving and Easter holidays. These rites, coming periodically, help to reinforce the habitual relations within the society, and their relative elaboration is a function of the gravity of the disturbance which it is their purpose to allay.

CHAPTER 22

Ritual Techniques—Magic

I. INTRODUCTION

In the preceding chapters of Part IV we have seen how the process of symbolization is associated with the development of Rites of Passage and Rites of Intensification. Each ceremony is made up of a sequence of contexts of situation derived from contexts of situation in use in different institutions in the society. These institutional contexts include techniques which when used in rites symbolize in the new context their former institutional referents. When a technique is used in this manner we have called it a *Ritual Technique,* by which we mean a technique used in a context to restore equilibrium. In the Rites of Intensification of the Omaha, just described, the techniques of painting the Sacred Pole with ocher and fat, putting swan's down and tobacco in the post hole, and setting up the Pole in the Sacred Lodge are all ritual techniques. The processes of building a house, as described for the Galla in Part II, and of setting up a tipi, insofar as they are not associated with any rite, are non-ritual techniques.

A commoner term for ritual techniques is the word *magic.* There has, however, been considerable argument about the definition of magic, particularly because many people have felt that magic was "evil" and must, therefore, be separated from religion, which was "good." From our point of view, such arguments are irrelevant, since they depend upon subjective interpretations of what the field worker thinks is going on in the mind of the native, and to a large extent any opinion depends upon who is performing the technique in question and under what circumstances. Once magic is said to be bad, the field worker finds identical rituals which he cannot help interpreting as "good," and then he is in a dilemma. We shall use magic in the sense of A. M. Tozzer, who defined magic as the technique of religion.[1] Since the term magic has for many persons a slightly suspect connotation, and for others is ambiguous, we shall use the term *ritual techniques* throughout. Moreover, where reference is made to the symbols associated or derived from ritual techniques, we shall use the term

[1] Tozzer, A. M., *Social Origins and Social Continuities,* New York, 1925.

ritual symbols rather than speak of *religion,* since we have limited this term to describe the religious institution, which is concerned, under the leadership of priest or shaman, with restoring the equilibrium of the individual or the group. In other words, we consider the experience of the restoration of equilibrium the fundamental thing, and the particular techniques and symbols making up the ritual incidental, since they vary from group to group.

Moreover, as we have seen in the case of economic and political institutions as well, techniques and symbols which are loosely referred to as *religious* are used in every institution. Together they form a configuration which is not limited to the single institution, since the circumstances calling them into operation, namely, disturbances of equilibrium, are common to every institution. The term *ritual,* therefore, is more properly limited to techniques and symbols forming parts of the Rites of Passage and the Rites of Intensification.

The use of ritual techniques, with which this chapter is concerned, develops as a result of disturbances in the interaction rates of individuals and groups. These techniques make up the ceremonies by which the equilibrium is restored. Each technique used in the rites provides a prescribed and ordered sequence of interaction, which acts as a mechanism to condition the people involved to a new state of equilibrium. To accomplish this, a ritual must provide a constant rhythm of interaction in which the orders and frequencies of origins and responses are fixed in terms of the relative positions in the sets. A given ritual technique can vary, however, in the number of individuals taking part and in the intensity of their interaction, and in the number of times it is repeated. These variations are a function of the magnitude of the change in interaction rates which evoked the ritual.

If a ritual technique is to have this effect, it must be one with which the individuals using it are already familiar, or else one familiar in the past which can be learned quickly and effectively. Most ritual techniques, therefore, are derived by the process of symbolization from the habitual technological practices of which the interaction of the individuals is composed. A simple example of this is the ritual meal which is found in all societies. The technique of eating in a prescribed and orderly way is obviously based upon the technique of eating meals practiced in everyday life. From what we know of the process of symbolization, it is evident that the habitual interaction of a group of people in eating would be one of the first things to take on ritual significance, because it is a regular activity with a high intensity in the interaction rates which take place within it. In many societies, special techniques within the meal have been separated out,

such as drinking, smoking, and the like; the tea ceremonial of Japan, the smoking of pipes among the American Indians, and the European ritual of offering drinks with toasts and clicking of glasses are examples. Of obvious importance also is the physiological effect of food and drink. It stimulates the parasympathetic system and reinforces the effect of the interaction in restoring the equilibrium of an individual.

Consideration of a meal as a ritual technique clearly brings out the basis on which many peoples classify techniques as sacred or profane, a distinction common in anthropological literature as well as in the beliefs of many peoples. A native informant may tell a field worker that a certain meal is sacred, representing a communion, while another one was profane, or just an ordinary, everyday meal. It sometimes happens that two such meals are indistinguishable in detail and in personnel, but the informant will insist that one is a sacred feast while the other is not. In all such cases it will be found that the sacred feast is a rite—that is, that it follows a disturbance in the interaction rates of the people. The term *sacred,* therefore, is equivalent to the term *ritual,* and the term *profane* represents those interactions within normal limits of variation without connotation of change.

Ritual techniques, as we have seen, provide a context of situation within which the interaction of individuals may be controlled. In so doing they prescribe differences in interaction rates, and these differences may vary from a complete prohibition of interaction in certain relationships to the enforcement of a high rate of interaction in others. In the same way, they may prevent the use of symbols of some systems and enforce that of others. Prohibitions enforced by ritual are generally called *tabus;* they may prevent sexual relations between classes of individuals, the eating of specific foods, the use of certain kinds of art, as among Moslems, who cannot represent human or animal life, the wearing of certain clothes, and so on.

Requirements or obligations which ritual may reinforce include the correct behavior towards one's elders or toward an official of the state, church, or business house; the wearing of proper clothing on different occasions; the proper way to address members of the opposite sex; what to do and what not to do in a boat; the right way to get on a horse, to handle a gun, to salute one's officers, etc. These are the things we learn to do at home and in school, in business and in the army. When we also use them as ritual techniques in the ceremonies of institutions, their daily practice is reinforced by ritual use, and we become highly conditioned to their performance. As we shall now see, in considering important classes of ritual techniques, those routines which have a high frequency in daily life pro-

vide the substance of ritual procedure. By examining the techniques in question we can see to what institutional context they can be referred.

II. RITUAL TECHNIQUES AND THEIR REFERENTS

In this section we shall endeavor to discover whence the techniques used in ritual are derived. We shall do this in order to make it clear that these have their origin in the routine activities of people. We are thus concerned with the environment, the various kinds of technology studied in Part II, and the special activities of some of the institutions as shown in Part III.

The Environment. One of the primary concerns of people in every society is the weather. It not only forms an important subject of conversation, but it is responsible for the growth or failure of crops, success in hunting or fishing, ease or difficulty in travel, and many other alternatives. Hence many of the most important changes in the interaction rates of people are due to the weather, and much of the ritual which people perform has the overt purpose of controlling it. The most powerful shamans in many societies are the rain-makers, because the adjustments which they produce in human relations through their ritual (Rites of Intensification) involve the greatest crises affecting the entire group.

As we shall see in the next chapter, some of the most important ritual symbols are derived directly from the environment, like the sun, the moon, thunder, the wind, stones, trees, springs, rivers, and mountains. But this is not, however, true of ritual techniques, although many of them use these natural phenomena as symbols. The reason for this, of course, is that ritual techniques impose regularities of interaction through the technical operations on which they are based.

There are, nevertheless, two aspects of the environment that are brought into many ritual techniques, if not most of them: these are *space* and *direction*. Everyone who takes part in a ceremony has to have some spatial relation to the other celebrants; this can be left to chance, or ritually regulated. Almost always there is some regulation of activity on this basis. The techniques of the dance, for example, usually require it; marching in columns and dancing in concentric rings are common features of rituals. Again, the spatial relations often symbolize the relations between individuals in hierarchies; the priest facing his congregation, the loyal subject walking backwards from the presence of his king, are examples. Among the commonest uses of spatial position in ritual are seating plans within houses; we shall take these up under the subject of ritual techniques derived from the context of houses.

Among the Omaha, whose ceremonial activities we have considered in some detail, the camp circle, or huthuga, provides a definite geographical distribution of families which is maintained in ceremonials. In the Hedewachi ceremony, which we described in the last chapter, the gentes have definite spatial positions, and much of the ceremonial activity consists of the movement of these gentes in space.

In the Christian marriage ceremony, the three stages of separation, transition, and incorporation are spatially represented. At the beginning of the ceremony, the bride, her father, and the bridesmaids, form a group separated from the rest of the people outside the chancel, and the groom, his best man and ushers are also separated. Then the two groups approach the altar; the father gives the bride away; and the bride, groom, best man, and maid of honor go up into the chancel. After the ring has been produced, the bride and groom kneel or stand directly outside the sanctuary, while the best man and the maid of honor remain a little behind. When the marriage is completed, the celebrants leave the chancel and march out of the church. The reception then takes place and all of the guests file up to greet the couple, shake hands with the groom and kiss the bride, completing the element of incorporation.

Ritual movements are concerned with space in more ways than the foregoing examples indicate. In discussing the couvade among the Buka people of Bougainville (pp. 489-490), we saw that definite restrictions were placed upon the geographical movements of the father. He first had to stay within his hut for a few days, and then within the confines of the village, and only after the last day could he go outside the village. As we pointed out, the area outside the village represented the territory in which hunting—a masculine activity—was performed.

The directions, too, are important parts of many rituals. This means that the actions of the celebrants are not only spatially regulated in terms of each other, but they must also be oriented. In many of the ceremonies of the American Indians, meal is sprinkled, or tobacco smoke blown, to the four points of the compass. A Moslem prays always in the direction of Mecca, and there is a mark in the wall of each mosque to indicate this direction. When he dies his grave is dug in such a way that he will be facing Mecca on the day of resurrection. In New Guinea, where the afterworld is supposed to lie over a certain range of hills, masked dancers representing the spirits of the dead come to the village from that direction to take part in ceremonies, and then return toward it.

Directions used in ritual are not limited to points of the compass; up and down are also acted out. The Yakut shaman dramatically ascends to

the heavens to talk with Erlik Khan by pretending to climb the center pole of the lodge, and the Chukchi shaman may drop out of sight through a hole in the ground. Gods and spirits are often thought of as living up in the air, and messages are sent upward by smoke, by gestures and by looking upward; the afterworld is often under the ground, and libations are poured on the ground for the benefit of its inhabitants.

Cutting Tools. As we saw in Part II, one of the most important aspects of technology involves the use of tools, and it is therefore not surprising that the manufacture and use of tools has widespread ritual significance. Perhaps the most dramatic example of this is the ceremonial adzes used in Polynesia, a simple form of which occurs in Tikopia. These adzes are believed to be sacred and are used on such occasions to mark changes in the operations connected with the construction of canoes, etc. In many places where cutting weapons play an important part in the activities of groups, they are used to symbolize the kind of interactions basic in the group's institutions. The knife and sword are perhaps the most common examples of these, but spears and axes are also of great importance. Among the Banyankole the sacred spears of the king were continually used to mark changes in administrative activity, particularly in association with war, and the sacred swords of the Japanese play an important part in their ceremonial activities. In England, the king touches a subject on the shoulder with a sword to confer the rank of knighthood; in war, when one commander surrenders to another, he hands over his sword. The ancient Druids in France and England used to cut mistletoe down from oak trees with golden sickles.

It should be noted that both the object and its use make up the context of situation, and although for convenience we are dealing only with the technique of use, nevertheless we must continually remember that ritual significance also attends the object, since both are part of the same context of situation.

Containers. The use of containers of various sorts, which we have described as one of the basic technical activities, plays an important part in ritual. Just as men use dishes and goblets, etc., in their everyday life, so the use of sacred goblets, plates, etc., makes up much of the ritual techniques. In Mesopotamia, throughout most of its history, one of the very important activities in the services at the temples was the preparation of meals in sacred vessels, and the celebration of ritual feasts. Among the Toda, a dairy ritual was performed in all the temples. It consisted of milking the cow buffalos into sacred vessels and making the milk into butter and buttermilk. The acts were simply repetitions of the ordinary ac-

tivities of the Toda dairymen carried out now by specialists using special vessels and special buffalo.

Fire. The manufacture and use of fire is, as we have seen in a number of instances, an important ritual technique. Among the Chukchi, the fire-board is used in the Reindeer Hearth ceremonies, and in many societies fire-making is associated with Rites of Intensification. Among the Creek, the annual purification ceremony is celebrated by the extinction of all the fires in the village and the building of new ones with brands taken from the sacred fire, which is lit for the purpose. In some places, as at the tomb of the Unknown Soldier, fire burns continuously and special individuals, such as Vestal Virgins in Rome and among the Incas in Peru, are held responsible for keeping this fire going. Fire is used ritually not only for warmth and protection, but also for cooking and for clearing the land in the slash-and-burn type of agriculture. Among the Bemba, the lighting of the fire which burns off the surplus vegetation preparatory to planting is begun in a ritual way by the king, and the rite furnishes the signal for setting fires in the individual plots. The use of fire in cooking is, of course, a necessary part of the ritual technique associated with food preparation and needs little exemplification.

Shelter. The techniques associated with shelter become of great importance in the more complex societies, where special buildings house religious institutions. A number of ceremonial activities are still in use, even in the United States; such activities are the turning of the first sod, the laying of the cornerstone, and the dedication of the completed building. Many of the other techniques, such as those involved in carpentry, masonry, and decorating, have at various times become important as ritual techniques. As already indicated, the Masonic order is based upon the technical activities of Masons, and its rituals are all elaborated around the construction of the temple. Not only is the construction of buildings for the especial use of religious institutions common, but we also find very characteristically in Polynesia and in Africa that the manufacture and use of model dwellings become part of the sacred rites. In the interior of a house, rooms and parts of rooms play an important role in controlling the actions of individuals in terms of spatial location, as we mentioned at the beginning of this discussion. Among the Omaha, therefore, there is an interesting extension of spatial position in the ritual activities of the huthuga. Among these people, the members of the family take up definite positions in the tipi; the father occupying the middle of the southern side, his wife next to him to the east, and the young warrior at the entrance. The rites of the gentes occupying these same locations in the camp circle are directly comparable: As the

Honga gens had under its direction the Sacred Pole ceremonies, which were associated with the political system, and the buffalo ceremonies, all male activities, while the rites associated with agriculture, the woman's occupation, were in the hands of the Inkecabe gens, the Honga pitched their tipis in the middle of the southern side, and the Inkecabe pitched theirs next to the Honga to the east.

Clothing and Bodily Decoration. The manufacture and use of clothing for ritual purposes are, of course, commonplace in ceremonials in the United States as well as elsewhere. Uniforms, robes, ceremonial regalia of all sorts are characteristic of our secret societies, our churches, and our universities. Among many peoples, the manufacture of the clothing of priests and rulers is associated with special preparation and with ritual procedure. Among the Incas, cloth spun from the wool of the vicuna was limited to the use of the Inca and members of the royal family, and it was woven at a special ceremony. Among the Plains Indians generally, the manufacture of war bonnets was not the work of the individual himself, although he gathered the material. Any man who was entitled to wear such a bonnet invited a number of his warrior friends to a feast, and each man counted his war honors on the eagle plumes. Since many of these bonnets contained fifty or more feathers, and since each feather had to have a war honor counted on it, and none could be mentioned twice, quite a number of helpers were required for its construction, and, therefore, the aspirant had to be able to get the required number of people to help him. The robes worn by kings and high nobles in Hawaii were made of yellow and red feathers; the higher the rank, the more yellow and the less red, until the robe of the king was all yellow. These feathers came from the tails of small birds, who had two such feathers each, and the yellow birds were the rarer. Therefore the amount of interaction required for the manufacture of such a robe was commensurate with the ritual importance of the person who wore it and the ceremonies in which he took part.

When we come to bodily decoration, we enter one of the most fertile fields of ritual technology. The scarification, tattooing, painting, hennaing, etc., of persons before or during Rites of Passage is one of the most commonplace and widespread practices found throughout the world. The symbolism of the marks or of the colors is often difficult to discover. Many peoples who use conventional or geometric designs in face painting and tattooing know only that a particular design stands for a particular relationship or condition. As a rule, however, red symbolizes blood and hence life, and red paint is put on the body particularly during periods of change in interaction rate, as before a war party or dance, just as we change our

clothing before a change of activity. Paint and clothing thus can symbolize interaction in age groups, in either of the sexes, and in various institutions and their activities.

Food Preparation. We have already seen how the use of the hand quern is of symbolic value in the interactions of the Moslem peoples of Arabia and North Africa. There are many other examples of a ritual use of cooking techniques, since they are used in almost all societies in this way. In ancient Greece, for example, we read of the funeral of Patroclus, how the mourners prepared the thighs of oxen by boning them and wrapping them in fat before putting them on the fire as a sacrifice. They also treated the body of the dead hero in much the same way, wrapping it in fat before putting it on the funeral pyre. In Polynesia, the making of the drink kava is almost always a ritual which has to be observed very carefully.

Sacrifice in general might also be placed in this category. This includes not only the ritual slaughtering of domestic animals, but also such simple practices as placing dishes of meal or other foods on a grave. These practices are so nearly universal that they hardly need further comment, except to call attention to the techniques of human sacrifice and ritual cannibalism practiced in many parts of the world. The formal killing of a human being is one of the most dramatic techniques found in any ritual, and will evoke a higher intensity of response than almost any other. This is especially true when it is conducted with great formality and with the aid of costumes, music, the dance, and other art forms. In the ritual meal which often follows human sacrifice, as in Central America, Polynesia, etc., the different parts of the human body take on special symbolic values.

Food-Gathering. The various techniques used in securing food, of which we have given a thorough survey in Part II, are all used as ritual techniques. In many cases we find the characteristic repetition of a technique before the individuals actually engage upon such a process. Thus in the Rites of Intensification, hunting people will act out the techniques used in hunting important animals. We have seen this in the ceremony of the Sacred White Buffalo Hide among the Omaha. Among the Bushmen of the Kalahari Desert, the Rites of Intensification include elaborate and mimetic dances in which the hunter acts out all the details of the hunt. A very common type of ritual object is the spirit trap which is modeled on ordinary traps used in hunting, and which form part of the ritual associated with shamanistic practices. In the same way, the techniques used in fishing are highly elaborated. In Tikopia, every movement which the bonito fishermen perform while they are in the boats is prescribed by ritual, and these ritual

techniques are often taken over into activities which were associated with fishing.

Agriculture. The ceremonies developed from agricultural procedures are so varied and complex that we can do little more than mention their existence. One of the most thorough-going accounts of agricultural magic is given by Malinowski in his classic work on Trobriand Island gardening, called *Coral Gardens and Their Magic.* Here he shows how each stage of the work in the garden involves the performance of ritual techniques derived from the process itself. Some of the most outstanding examples of the use of such techniques come from Melanesia as a whole, where many students have worked on this subject.

We have already seen how in Peru, the Inca started off the agricultural work of the season by following out the exact routine of preparing the ground. Among the Natchez Indians of Mississippi, the king was carried out to the sacred cornfield on a litter at the time of the first ripening, and he picked the first ears, after which the people next in rank picked; this sacred corn was ritually ground and cooked, and everyone ate some of it. There are many examples of the ritual use of the first fruits in Mediterranean countries, where harvest ceremonies are common, and many references to this will be found in the Bible. In the same way, in Egypt, the ritual plowing of the land preceded the actual plowing by the farmers, and for every group it can be stated that agricultural techniques are associated with the changing relations of individuals. As we shall see later in this chapter, though these techniques first become ritualized in the agricultural process itself, they later, through the process of equivalation, may be associated with other institutions.

Animal Husbandry. In the same way, in societies which are dependent upon pastoral activities and the care of herds, the rituals in common use are derived from them. In Judaism and in Christianity we have the symbolism of the religious leader as a shepherd and his followers as sheep, as the Twenty-third Psalm so beautifully illustrates. In the Christian Church the bishop's staff is in the form of a shepherd's crook. Among the Galla of Ethiopia, after sacrifices to Wakaimu, a universal spirit comparable to Wakoṇda, the priest and the celebrants hang the intestines of cattle about their necks and shoulders. Among all the cattle people of East Africa, such as the Banyankole and the Bakitara, the principal rites are associated with the care and sacrifice of cattle. Among the Toda, the funeral ceremony involves killing of a buffalo, and placing the dead man's hand upon its horn (see p. 496). The buffalo plays a prominent part in all Toda ceremonies, which we have already mentioned in connection with their dairy ritual.

Among the Hindus, the rites associated with the care of their sacred cows in temples are merely an elaboration of the ordinary practices of looking after cows in daily life.

One of the clearest examples of pastoral symbolism is found in the description of a yurt, or tent, of a Mongol chief in the days of Genghis Khan. Facing the door was the section reserved as a shrine, with a felt image symbolizing the spirit of the house hanging over it. Over the master's place, on the right, was a felt replica of a mare's udder; over the mistress's, on the left, a similar representation of a cow's udder. By the door was a butt of kumiss, which all who entered were free to drink, and before a meal or any ceremony the master had a servant sprinkle kumiss on the felt images and on the ground outside in the cardinal directions.

Transportation. In Chapters 9 and 10 we saw how important transportation is in the development of complexity in human civilization. This importance can be further seen by considering how much ritual is based on transportation, the use of its techniques. Among the Tungus, for example, each clan owns a number of sacred reindeer, often white, which cannot be ridden or packed, and which are supposed to furnish transportation for the spirits of the clan, through the agency of small idols which the reindeer carry. Among the Yakuts, white horses have the same use. Among the Bedouin, each tribe has a sacred litter called *el markab* (the ship). This is a camel litter decorated with ostrich plumes. In camp, it is kept by the tribal chief, who guards it closely. On the march, it is strapped on a sacred camel and no one rides in it. The Bedouin say that God perches now and then in this litter, and you can see the feathers rustle while He is in it. In very serious battles, when things were going badly, the most attractive young girls of the tribe used to get into the litter and strip to the waist, riding around shouting to the men to fight bravely. In this case, as in the others, a symbol taken from the context of transportation symbolized the relationships of the tribe as a whole, a concept similar to our "ship of state."

Carts and wagons, of course, are other prime symbols. In Europe throughout the Bronze Age and part of the Iron Age, warriors would be buried under their chariots, and a mound heaped over the whole. In Scandinavia, particularly in Norway, this custom was changed to ship burial, as the invaders of the early Iron Age took over ships in place of chariots as their principal means of transportation. In Mesopotamia and Egypt, model ships are found in graves as part of the equipment intended for the spirit of the dead. In the Nicobar Islands, a model ship is sent off on the off-shore breeze at the turn of the monsoon, to carry all the sickness out of the island.

In Polynesia, of course, the use of ship techniques in ritual is very great. In our own country we use it a great deal also; our hymns contain many references to "crossing the bar," "the perils of the deep," etc. Even in aviation, ritual has already begun to develop.

Ritual Techniques Derived from Non-Technological Systems. Aside from technology itself, there are many systems of techniques which do not involve the manufacture of objects, the acquisition of food, or the transportation of persons and materials. These techniques form systems of their own and have developed, as we shall see in Part V, symbolic configurations of techniques and their dependent symbols directly comparable to the one we are now studying, ritual. Of these, one of the most important is that associated with language, to be dealt with in Chapter 24. What we are interested in at the moment is how the techniques of speaking, writing, and the like have been taken over into ritual. This does not include the use of daily speech in the ritual; what we mean is the ritual representation of language, in words or otherwise.

For example, when a shaman is acting out a conversation with a spirit, he will often do this in a strange language which his clients do not understand; a Chukchi shaman may speak Russian or English or a gibberish which he has made up; he will have an assistant, in many cases, who will "translate" the spirit language into Chukchi. Even when the language is the same, it may take an archaic form, as in Jibaro ritual, where also many Quechua (Inca) words are included. Again, the shaman will usually speak in a strange voice, or he may act out spirit-talk by means of ventriloquism. This is particularly common among American Indians and in Siberia, but it is found almost everywhere.

Prayer is a formal, ritualized way of speaking in order to communicate with gods or spirits, and prayers take stereotyped forms, and are repeated over and over. They often must be accompanied by appropriate actions: lifting the arms and looking upward, to indicate the superior position of the spirit, or kneeling or prostrating oneself as before a leader in any kind of administrative set. Among the Ostiaks of the Obi River country, the priest and all others trying to communicate with a spirit shout as loudly as possible to be sure that the god will hear. The procedure is to take a reindeer to the idol of the god, kill the reindeer, and at the moment of the reindeer's death to shriek out the prayer. The spirit of the reindeer will thus take it upward. In Colombia, the Chibcha Indians used to train parrots to recite prayers, and then sacrifice them, so that their spirits could repeat the prayers to the gods. In Benin, when a king killed sacrificial victims in the annual ceremonies at the anniversary of the death of the former king,

he would say to each man as he hit him, "Go tell my father such-and-such, and that I will join him soon."

Another equally common symbol is smoke, which rises in the air. Many peoples signal each other by smoke columns, and of course this is an easy way of attracting attention. The Greeks had the idea that the gods liked the smell of cooking meat, and used this as a rationalization for parts of their sacrifices. The idea seems to have been that the smell would attract the god's attention and cause him to listen. Incense, throughout the world, is used as a means of creating sweet-smelling smoke; in the Old World the commonest incenses are frankincense and myrrh, and in the New World copal gum and tobacco.

Writing, too, is often used in ritual. In North Africa and in Arabia, as well as in many other countries, a sick man may be given a written charm, inscribed with suitable formulae. This may in some instances be attached to the ailing part of his body, or it may be soaked off in water and given him to drink. Again, prophylactic charms, or amulets, may be given him to prevent disturbances such as illness, jail, or marital infidelity.

Techniques Derived from Physiological Processes. Many of the techniques which furnish the symbolic content of ritual are derived from the ordinary workings of the human body. We have already seen how eating is one of the commonest of these routines, and how it serves to symbolize the activities of the family. Another is, of course, the sexual act, which is a part of rituals in many societies. In Melanesia, it is common for a man and his wife to have intercourse in their garden, because the garden is where they work together and thus furnishes the context of their most frequent and most intense interaction. It forms part of a Rite of Intensification associated with agricultural crises. A ritual found in the Middle Ages in parts of Europe, and in many other parts of the world, is the *Jus primae noctis,* by which the head of an institution has the right to deflower the bride of one of his subordinates. This is, of course, a Rite of Passage which serves to emphasize the relations of the individuals in the set, and by which the changes in beginning the marriage relationship are compensated for within the feudal institution.

Spitting may also be a part of ritual. In Moslem countries, a descendant of the prophet is supposed to cure people of various ailments by spitting in their mouths. Among the Hottentots, urinating on people serves the same effect; in a Rite of Passage, an old man will urinate upon the young men who are being initiated or who are passing through a critical period; it is a symbol of the stage of incorporation. Many shamans, in fact most shamans in the simpler levels of society, suck the bodies of their patients, overtly

to remove magically injected disease objects. As we have seen, the Andamanese weep together, and many people use kissing as a ritual. In all of the cases mentioned, except for mutual weeping, the technique symbolizes the order of action in which one person originates to another person or persons. One of the best examples of other such techniques is found in our own society; among many others, the hand-shake, which is the ordinary method of greeting. Not only is this part of the ordinary interaction, but it plays an important part in the rituals of churches and of associations, where it is usually referred to as "giving the right hand of fellowship." In other societies, as for example in Mesopotamia and in China, bowing is the habitual form of greeting, and this is employed not only in daily life but also in the rituals of the various churches. We are already familiar with the weeping of the Andamanese, and the well-known nose-rubbing of the Eskimo may be cited as a further example.

Among other systems of techniques, not included under technology itself, which we have restricted to manufacturing, the acquisition of food, and transportation, are the techniques associated with education, with competition or even of ritual itself.

In many associations, rituals are held in which the new member is initiated by being made to act out being born, growing up under the tutelage of older members, and finally arriving at manhood. In the family itself, a person being adopted is supposed, in many societies, to crawl between the legs of the mother of the family to imitate birth. It occasionally happens that the ritual of one religious system imitates or symbolizes the ritual of another, as when the Mass is said backward in the Black Mass, or Witches' Sabbath; but this is relatively uncommon, since it only occurs when the members of the two systems are in a state of conflict.

The most common of all ritual techniques derived from other technical systems are those of competition, particularly of warfare. Many of the practices included under the so-called "black magic," or harmful magic, fall into this category. Let us consider a few examples. When a Bushman, for example, wishes to harm an enemy, he takes a tiny model bow, called a "bushman revolver," with porcupine quills stuck in the string. He sneaks up behind his enemy, muttering a formula of imprecation, and twangs the string. By this ritual means he attempts to inject magical shafts into his foe, and thus sooner or later cause his death. An Australian does the same thing by bone-pointing. He shapes a pencil-like piece of bone, and getting behind his enemy, "jerks" it back and forth in his direction. In some cases, he uses two bones connected by a cord of human hair, and has an assistant hold the back piece. By means of this longer device he can get a more

accurate sight on his victim. The Micmac Indians of Nova Scotia, long after the arrival of the whites, used to load shotguns with a charge of black powder and a bundle of needles, and then shoot the needles in the air in the direction of an enemy, who might be several miles away. Sometimes these practices are not wholly confined to ritual; in Australia, one way of getting rid of an enemy is to shove thin, sharp slivers of very hard wood into his neck, where they will cause internal injuries yet leave no perceptible hole in the skin.

Magic of this kind, however, is not the only ritual use of the techniques of warfare. We have already seen how the Jivaro Indians wave their spears in warlike movements in the *enéma* ritual. Almost all peoples who go on war expeditions go through war dances or other rituals mimetic of warfare before starting out, and many rituals used for other purposes, like the club dances of the Fiji Islanders or the acting out of war deeds in the Omaha Ceremony of the Hedewachi, are drawn from the context of war.

III. TYPES OF MAGIC: CONTAGIOUS AND IMITATIVE

In this extensive survey of ritual techniques, we have seen how those common to a particular group derive from the routine techniques in which the interaction reaches a moderately high frequency. The Omaha Indian commonly uses ritual techniques which are derived from the buffalo hunt, an occasion involving complex interaction; there is, however, no ritual technique derived from the gathering of wild turnips, which involves no interaction at all.

As we made our survey of ritual techniques, however, two general types could have been distinguished which result from the differential operation of the conditioning mechanism. These types were first isolated by Sir James Fraser, and he called them *contagious* and *imitative* magic.[2] In the first of these, the so-called Contagious Magic, the ritual technique is built up out of the association of objects, often purely by chance, in a context which occurs repeatedly. In this type of magic, the process of symbolization, described in Chapter 19, is at work. When any given context occurs with sufficient frequency, an element of that context can become the symbol for the whole. For example, any part of a man, a piece of his clothing, the parings of his nails, a bit of a hair, a footprint, can through the process of symbolization stand for the whole man, and the ritual technique will then involve the part which is the symbol for the whole. Scholars often like to refer to this aspect of the conditioned response by talking of the "pars pro toto," meaning a part for the whole. Fraser and many scholars since have

[2] Fraser, J. G., *The Golden Bough,* New York, 1923.

collected innumerable examples of contagious magic. They have shown that the process of association can be stretched to include almost any arbitrary linkages, emblems of emblems, and so on, just as Pavlov and his followers (as we saw in Chapter 3) have shown for animals how widely different stimuli can be linked together in almost any context.

R. H. Lowie, in a chapter on the process of association in his book on primitive religion, has given a good account of the way in which new ritual techniques and symbols arise by the process of linkage and equivalence.[3] Old symbols are juxtaposed with new ones, either through borrowing from other groups, or through fashion within the group, consequent upon the activities of leaders who are able to get their followers to learn and practice these new techniques. We shall refer to the influence of leaders a little later in this section.

The second type of ritual technique differentiated by Fraser, Imitative Magic, is one in which the ritual technique consists of an imitation of the basic technique itself. A man about to begin sowing goes through a ritual in which he mimics the activity he is about to undertake. The Bushman who wishes to kill someone by magic uses the "revolver" technique, which is immediately derived from the action of shooting. The Bushman hunter, earlier referred to, mimics his activities in the hunt, while the Omaha warrior acts out in a ritual warlike deeds he has accomplished and hopes to perform again. The basic mechanism of conditioning here involved is the necessity of reinforcing a technique by actually working it out. Thus by acting out a buffalo-hunting technique, imitatively and in a derived context, as part of the ritual in the Ceremony of the Sacred Pole, the Omaha are able to maintain that particular conditioned response. Its occurrence at regular intervals in the cycle of technological change maintains the context in operation, and the actual performance of the technological action itself, when this happens, in turn reinforces the ritual technique. All such activities which involve the manufacture or use of objects, the ordered interaction of individuals in terms of technological procedures in Rites of Passage and Rites of Intensification, make up the substance of Imitative Magic.

Although these two types of ritual techniques can thus be conveniently separated, in actual practice every rite is likely to have both imitative and contagious elements. In the description of the rites associated with the Ceremony of the Sacred Pole, the use of buffalo fat and the pieces of meat called Tezhu definitely involve Contagious Magic. Moreover, the use of different colors to symbolize different interaction situations is again pri-

[3] Lowie, R. H., *Primitive Religion*, New York, 1924, Chapter 13.

marily a contagious element of magical practice. The color red symbolizes life, joy, excitement, while black is the color of war and of death. In different tribes, the color symbolism may change. Among the Creek, red is the color of war and white of peace, while among the Omaha, in spite of their fondness for giving albino animals ritual significance, the color white has no major significance in ritual decoration.

The Individual Leader and Changes in Ceremonial. In discussing the process by which the conditioning of the individual brings about the development of ceremonial, we must not forget the part played by the individual himself. We have already seen in Parts I and III the importance of individual variability in the development of institutions. In particular we have seen that leaders build up institutions, and as we have already pointed out in the chapter on religious institutions, these leaders develop their following by using ritual techniques and symbols. Individuals who have a high origin rate are able not only to assemble a group of followers, but also in the course of this process to develop new ritual procedures. Thus Lowie describes how among the Crow Indians a man named Medicine Crow built up a chapter in the Tobacco Society on the basis of a vision in which there was a linkage between the tobacco and the strawberry plant, and he also succeeded in substituting the crane, a bird which had played an important part in both his and his father's experiences, in the place of the traditional otter skin.[4] In this case, an association of two symbols in an individual's system of relations was taught by the man to his followers, and thus a group of individuals developed whose ritual symbols and techniques differed from that of other groups within the same general system of practice.

If we are to understand the history of ritual symbols and techniques, the part played by individual leaders cannot be overestimated. Any extensive modification of symbolism occurs only when the whole structure of the society is modified through the stress of a changing environment, through changing technology or through the development of leaders. In each case, of course, changes are brought about under the leaders in the system, but in the first two cases, the symbols substituted for older symbols in response to these changes are easily derived from the situation, while those due to the rise of leaders alone may often bring about more personal associations of symbols due to the eccentricities of personality. Medicine Crow is a good example of this, but Lowie gives another case which illustrates even better the vagaries of the process of linkage. Among the Oglala Sioux, Wissler discovered that some leader had founded a Badger Society

[4] Lowie, Robert H., *The Crow Indians*, New York, 1935, pp. 280-285.

on the model of its Crow namesake; Lowie, however, had found no such society among the Crow. He found, however, that the Oglala word for badger was almost the same as the Crow word for kit-fox, and the Crow had an association by this name. As Lowie points out, the use of the name Badger could easily involve changes in the symbolic paraphernalia of the society, as a result of this mistaken identity of names.

Quantitative Differences in Ritual Techniques. In the process of the development of ritual techniques, there is a considerable variation in the elaboration of the ceremony and in the number of participants. In many cases only the individual shaman and his client are involved in the interaction. Some ritual techniques, of course, which constitute parts of a sequence, may involve the activity of an individual without interaction. As techniques become more elaborate, the number of people who take part increases until, as in such tribal ceremonies as the Hedewachi Ceremony, all members of the group take part. In many descriptions of ceremonials it is not clear how extended this participation is, since it is a failing of field workers to neglect the responses of the audience because they are concentrating upon the actors. In ceremonies, however, where the details are fairly clear, there is a continual alternation between events involving the priests, or principal actors, and all the spectators. Thus, in the Sacred Pole Ceremony, much of the ritual involves only the interaction of man and wife, but at other times set events involving different classes of terminators were taking place.

Not only do differences in ceremonial activities depend upon the number of people involved and the frequency of interaction, but there is also a tremendous variation, as we have already pointed out, in the length of the periods of interaction and in the quantitative aspects of the interaction in each event. The performance of some of the rituals in the Russian Orthodox Church takes more than six hours, and in the initiation ceremony in the Dahomean Church, the rites last for ten days with only brief pauses between each section. Among the Australians, the Murngin totemic ceremonies may last an entire season. During this period, therefore, the members of the society are interacting at a definite, constant rate, and the effect is to stabilize the relations of the individuals and thus restore the equilibrium. In general, in any society, the length of the ceremony determines its importance, and this in turn is dependent upon the necessities of the system whose state of equilibrium is to be restored. This was brought out when we were discussing the Rites of Passage, where we saw that the elaborateness of the ceremony associated with a crisis such as death

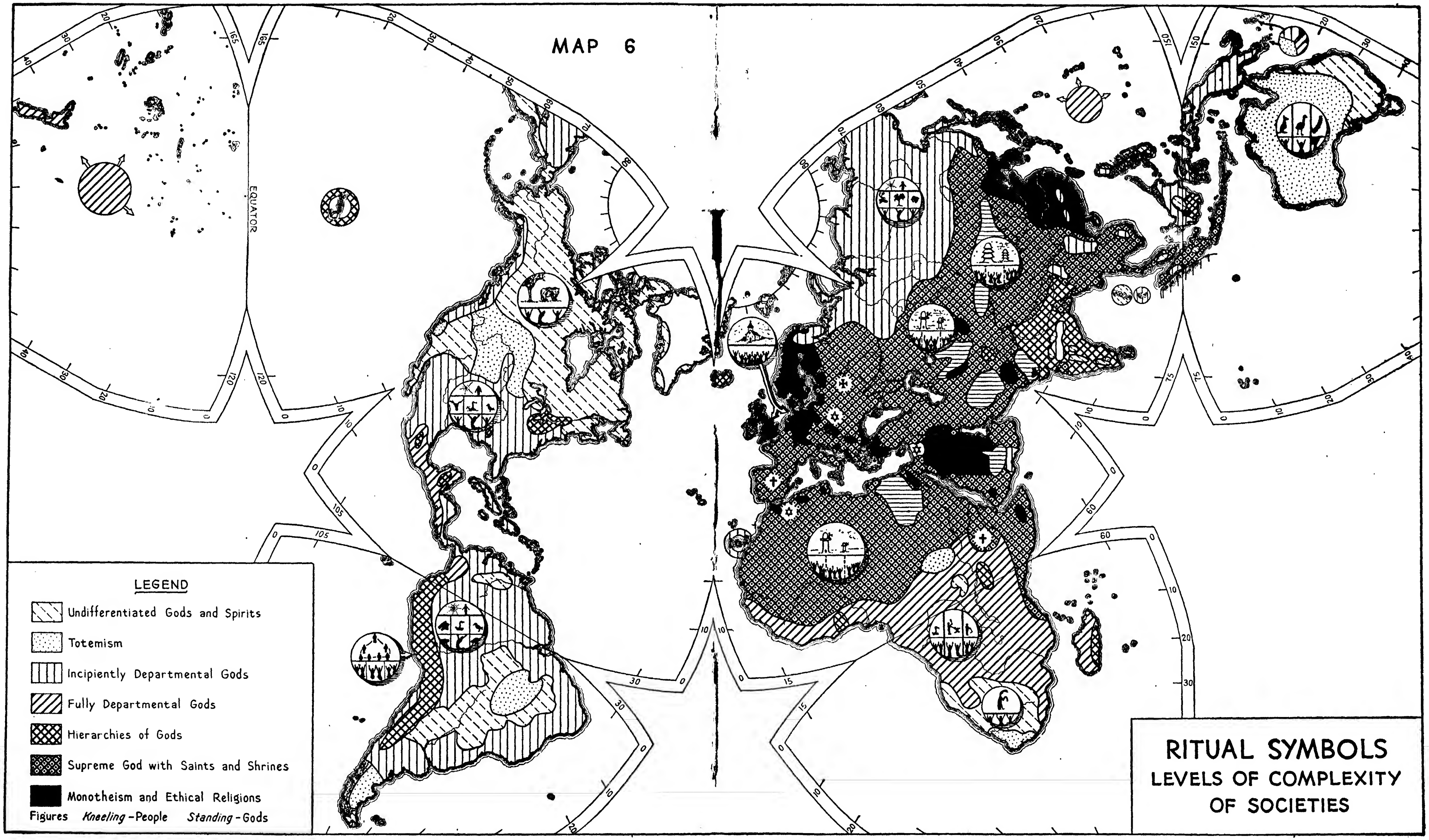
was dependent upon the extent and the rates of the interactions of the deceased. The same thing is true of the Rites of Intensification.

Conclusion. In this chapter we have seen how the ritual techniques making up the Rites of Passage and the Rites of Intensification appear to be the result of disturbances in the interaction rates of individuals. The process of symbolization based upon the mechanism of the conditioned response derives these ritual techniques and their associated symbols from techniques, either technological or otherwise, which occur with sufficient frequency to form the principal context of situation for interaction in the system. We have shown that this process of symbolization operates in two ways, one by the process of what we commonly call "association," by which symbols arbitrarily become linked together through repetition. This is what is known as Contagious Magic. The second type develops from the other aspect of the process of conditioning, namely, the necessity for reinforcement of the conditioned responses making up the interactions of an individual. This results in that great class of ritual techniques which Fraser called Imitative Magic, where a sequence of activities which have ritual significance is directly derived from their daily performance. The two processes, repetition and reinforcement, are intricately associated and can only be somewhat arbitrarily separated. As we shall now see, even the distinction between ritual technique and ritual symbols, however convenient for purposes of exposition, involves a distinction between the object itself and the activity connected with the object which is not borne out in practice.

SUMMARY

Rites of Passage and of Intensification can, for convenience, be divided into two elements—ritual techniques and the symbols themselves in terms of which the techniques are performed. Ritual techniques are what is commonly known as *magic*. Ritual techniques and ritual symbols together make up a configuration comparable to other symbolic configurations, each with its techniques and symbols, examples of which we shall give in Part V. Ritual techniques and symbols are concerned with the restoration of equilibrium, just as law, as we shall see later, is concerned with its maintenance. Ritual techniques may be used in any institution but they are most characteristic of religious institutions.

Ritual techniques are derived from the context of all kinds of human and other activity. Some are derived from the environment, as in the case of rain-making ceremonies, and in the symbolic use of spatial position and direction. Others are derived from technology, such as the techniques of cutting with edged tools, making containers, kindling fire, building houses,



In this map each circle is divided horizontally; in the upper half are ritual symbols, in the lower, worshipers. Where the worshipers are divided into groups by vertical lines, different people in the society use different symbols. The symbols illustrated are those characteristic of each area. Where gods and totems both appear, the upper half of the circle is horizontally subdivided. The world religions, such as Christianity and Islam, are symbolized by their most characteristic religious edifices.

putting on and taking off special garments and ornaments, preparing and eating food, hunting, farming, herding, and transportation; in fact they may include any technological activity which furnishes the context of interaction for a number of people, and the more interaction and the more people concerned, the more likely a given technique is to be selected. Other techniques are selected from the fields of human relations alone, such as prayer, which represents communication, sexual intercourse, the kiss, and the handshake. Still others, including most of the techniques of "harmful" magic, are derived from warfare.

Magical techniques can arise from linkages, through the process of symbolization; either through the selection of a part for the whole, as when nail parings are used to represent the victim, or through imitation, as pretending to shoot a toy bow in the direction of an enemy. Changes in ritual techniques, like changes in other types of behavior, are often caused by the influence of individual leaders, as well as by changes in environment, technology, and institutions. The length of a ceremony and the number of persons who participate in it either as actors or audience are functions of the quantitative value of the disturbance it is to allay, as we have seen in the chapters on the Rites of Passage and of Intensification.

CHAPTER 23

Ritual Symbols—The Supernatural World

I. INTRODUCTION

In the last chapter we dealt extensively with the ritual techniques which make up the contexts of situation in the Rites of Passage and the Rites of Intensification. In each case, we saw that these techniques were composed of the activities and interactions of individuals, ordinarily in association with places, objects, animals, persons and other aspects of the environment. We concentrated more upon the technique as a whole, but as we pointed out at the very end of the chapter, and as was evident throughout, the process by which these techniques become ritualized involves, as part of the process, the actual objects, persons, and so forth, as symbols. Each of these symbols then stands for part of the context and thus for the techniques associated with it.

We saw, for example, the importance of spatial location in ritual techniques; the ways in which individuals interacted in definite and regular ways consequent upon their location in the house or in the village or surrounding countryside. Among pastoral peoples, we saw that much of the ritual technique was associated with the care of animals, and although we did not stress it, it was apparent that the animals among the Toda were ritual symbols just as much as the performance of milking the "sacred" buffalo was a ritual technique. One obviously could not be separated from the other. For convenience in exposition only, we dealt with the techniques first. We shall now see how these associated objects, animals, persons, and so on become symbols of the restoration of equilibrium for individuals and groups, and become endowed with the emotional attributes of the ceremonies of which they are a part. In other words, we shall deal with the symbols associated with ritual, with totems, spirits, and gods, which make up what is often referred to as the supernatural world.

But this supernatural world differs for different peoples. If, in fact, the totems, spirits and gods symbolize the relationships of individuals in a given group, we should expect to find that different levels of institutional complexity differed also in the degree of elaboration of their ritual symbols.

Using the levels of institutional complexity worked out in Chapter 18, let us see what kinds of ritual symbols accompany each level. These levels are:

1. Simple Family Organization.
2. Extended Family Organization.
3. A Few Simple Institutions, other than the Family and other than Associations derived from tangent Family Institutions.
4. Many Simple Non-Familial Institutions.
5. One Complex or Hierarchical Non-Familial Institution, with a Number of Simple Ones.
6. Many Complex Non-Familial Institutions, with Few Associations.
7. Many Complex Non-Familial Institutions, with Many Associations.

II. HOW RITUAL SYMBOLS ARE RELATED TO INSTITUTIONS AT DIFFERENT LEVELS OF COMPLEXITY

In groups of people on the simplest level of complexity, the lack of hierarchical organization seems to prevent the symbols from becoming combined together into a single configuration. Thus among the Andamanese, objects derived from the local technology such as hibiscus fiber and tetranthera wood have a specific action which is independent of the generalized force called "ot-kimil," which symbolizes the period of marked changes in the interaction rates of individuals. The ritual symbols of the Andamanese, therefore, are specific in character. They are associated with the reinforcement of habitual interactions in the Rites of Intensification and in restoring equilibrium in the Rites of Passage. Their ritual symbols are derived from the presence of objects, animals, etc., in specific contexts of situation. Radcliffe-Brown gives a short and simple example in his discussion of the cicada, which illustrates both a Rite of Intensification of a simple sort and also a myth. According to one group of the Andamanese, one of their ancestors killed a cicada, which uttered a cry, and as a result darkness covered the earth. The cicada, like a cricket, sings during the short interval of twilight. Thus the habitual association of the song of the cicada with twilight produces this symbolization.

In one of the Andaman tribes, there is a ceremony which involves the killing of a cicada. This is associated with the fact that the cicada sings only during the stormy season. At the end of the stormy season, a ceremony is held, which consists of making a tremendous noise during the time the cicada is singing. This noise is ordinarily forbidden, but at this period, the noise offends the cicada and drives him away, and good weather results. Thus the ceremony is concerned with an insect which happens to be associated with the change in season.

One further point is worth mentioning in this connection, and that is the importance of two mythical beings (ritual symbols), which the Andamanese call Biliku and Tarai. Biliku is associated with the northeast monsoon and the cool and hot seasons and Tarai with the southwest monsoon and the rainy season. We have already seen in Chapter 18 how a change in interaction rates is determined by these seasonal changes, and as a result we find that myths which describe the activities of these beings also describe the activity of the Andamanese during the corresponding periods of the year. Thus Biliku is responsible for cyclones, and can always be counted on to be angry and send bad weather when beeswax is burned, which merely means that the period of collecting honey and melting down the wax is immediately followed by bad weather. So too, the cicada, which we have just mentioned, is associated with Biliku, and Biliku again is angry. This concept is derived from the fact that the grub of the cicada is eaten during the period of cyclonic storms. Radcliffe-Brown has followed out this process in detail, but it is sufficient for our purposes to say that the habitual interactions of the individuals during their yearly round are symbolized by beliefs in mythical beings, among whose attributes are the objects, animals, insects, etc., which are present or active during these periods.

On the second level of complexity, where an elaborate process of segmentation within the family system has taken place, we find the development of a symbolic system called "Totemism." The work of Sharp[1] is principally responsible for our present understanding of the complexities in the process of symbolization found in Australia. He first pointed out that not only was there an elaborate development of symbols associated with clans and moieties, which were derived from the important techniques making up the technology, but also

> that totems are by no means limited to species of animals, plants and other natural phenomena, but include such abstract concepts as sexual passion, adolescence, various diseases, swimming, copulating, making a spear, vomiting, colors, psychological moods, heat and cold, and so on. Numerous too are such substantives as corpse, ghost, child, ritual paraphernalia and other cultural artifacts. It appears that a totem may be any enduring element of the physical or mental environment, either unique conceptual entities, or, more frequently, classes or species of things, activities, states, or qualities which are constantly recurring and are thus considered to be perdurable.

Sharp points out that totemic rites are divided into those which are associated with the Rites of Passage and in particular the mourning rite,

[1] Sharp, L. W., "Notes on Northeast Australian Totemism," Dixon Memorial Volume, *Peabody Museum Papers,* Cambridge, Mass., Vol. 20, 1942.

and those rites which we call Rites of Intensification, which are concerned with (1) the increase of the quantity of totems, which he calls "Totemic Control Rites," and which are generally referred to within the literature as *Increase Ceremonies;* and (2) the historical rites in which the members of totemic groups act out the way things were in ancestral times.

Since it is believed that the daily life of a community exactly mirrors the daily life of the ancestors, these rites consist of the elaboration of techniques in terms of ritual symbols. Here, as in the lower level of complexity, there is only a generalized relationship between the various symbolic activities. The seasonal shifts play a part similar to that found among the Andamanese, with the difference that in Australia, the segmentation of the group into clans and moieties involves the interactions of the individuals in each separate sub-system with their symbols in the ceremonies. Therefore in the myth, the mythical beings representing the seasons are more systematically associated symbolically with the totemic symbols.

On the third level of complexity we find the segregation of specific spirits which symbolize specific techniques. For example, among the Chukchi, there is a special being which is the "owner" of the domestic reindeer, and which must be propitiated if the herds are to multiply and prosper. There is also another being which is responsible for the forests and the wild animals and trees used in making artifacts. Among the Chukchi, most of the men are reindeer breeders, and while a few are traders and others shamans, all depend eventually on reindeer breeding for their livelihood. Aside from the "owners," the Chukchi also believe in local "ground spirits" which symbolize definite places and which must be propitiated, and also spirits symbolizing the household through their association with the family tent. If a family dies out, no one else can use their tent and it must stand empty until it decays.

Among the Omaha (see Chapter 21) there were several separate institutions, in which the hierarchical system was only weakly developed. These institutions, which operated only seasonally and under the control of the Council of the Tribe, were made up of Seven Peace Chiefs and the principal Keepers, had separate symbols, such as the buffalo, thunder, etc., while Wakonda symbolized the unified authority of the tribal leaders. The war god, Thunder, was regarded as a special manifestation of Wakonda, and the totems of the tribe were representations of the objects used in the Rites of Intensification which produced a unified system.

In the fourth stage, we find a symbolization of special activities performed by specialists, as in Polynesia where there were special gods for carpenters, sailors, farmers, and the like. This is particularly clear among

the Aztecs where the warriors, traders, farmers, and craftsmen, had their own gods, and the rites for each were different. For example, farmers were buried, since they worshiped a god associated with rain and the earth, and they had to be placed within the earth. The worshipers of most of the other gods were cremated.

In the fifth stage, these separate gods are maintained, but they become mythologically related to each other, and one of them becomes a paramount god, controlling the actions of the others. Probably the clearest example of this is in India, where different castes have their own gods and all are united under the leadership of Brahma. In ancient Greece, these gods had their special devotees or clients, and were supposed to come down from Olympus and guide them during particular crises. At this level one finds a development of sects or cults, in which each sect in the group represents a system which is highly isolated from the others. Consequently the relations between the members of one church or cult and another may be in a state of equilibrium, as in India or Dahomey, where the development of a strong political institution has brought about in the myths a rationalization of the relationships and activities of the different cults.

The sixth stage is really a combination of the fifth and the seventh, in which a monotheistic system has often been imposed on an earlier polytheism, and the departmental and local gods have been rationalized into the new system. For example, in Morocco, one finds local shrines, located at springs, on mountains, etc., to which a woman can come to sleep if she wishes to become pregnant, or a man if he wishes to be cured of a specific kind of ailment. Some local leader of great sanctity dies and is buried at such a spot, and a tomb is erected over him. The pilgrims continue to come, but now they sleep in the tomb and their pregnancy or cure or whatever is attributed to the "baraka," or symbolic power of the saint which he received from God. At Lourdes, in France, where miraculous cures are performed through the agency of water from a sacred spring, the water is said to derive its powers from the miraculous appearance of an image of the Virgin. Archaeological investigations have shown that this spring was used for this same purpose long before the development of Christianity.

The seventh stage needs little exemplification. Early Christianity, Judaism, and the "purer" sects of Islam all belong to it, as do "pure" Buddhism and Confucianism. The one god may be a tribal god, which has superseded all others, as in the case of Judaism, or a supreme being derived from the complex interrelation of institutions, as in modern Christianity. In the case of Judaism, the high rate of interaction of the group, due to outside pressure, has fostered the retention of a single god despite specialization in occupa-

tion. Peoples who have developed monotheistic gods, or gods which in some cases belong to the sixth category, often also develop "churches militant," like Christianity, Islam, and Buddhism, which send missionaries out to convert other peoples. Whereas the Greeks and Romans tried to equate the gods of new peoples whom they conquered or encountered with their own, matching a thunder god with Zeus or Jupiter, an earth goddess with Demeter, a horse god with Poseidon, etc., the monotheists attempt to apply their universal gods to all.

From the results of this survey of the ritual symbols associated with each level of institutional complexity, we can now outline seven distinct symbolic levels.

1. Undifferentiated gods and spirits, serving the society as a whole, as, for example, the spirits of the two monsoon seasons among the Andamanese. In this, as in the other levels, there may in some cases be a "supreme being," a vague, often amorphous god which receives, however, little ritual attention.

2. Totemism: separate symbols for clans, families, and familial associations, and in some cases for individuals. At this level one may also find *genii loci,* or spirits associated with specific spots on the landscape to which particular individuals or groups of individuals are also associated.

3. Departmental gods in the form of "owners"; for example, a spirit controlling the reindeer among the Chukchi, or the turtles among the Kiwai Papuans of New Guinea, who hunt turtles. These gods symbolize interaction in specific activities which part, if not all, of the individuals perform. They may, for example, refer to the activities of a single sex or age group, or the activities of segments of such groups. However, the spirits have reference to the group as a whole, since all partake of the results of these activities.

4. Departmental gods which specialize as men specialize, and which are not applicable to the group as a whole. These include carpenters' gods, sailors' gods, merchants' gods, etc. There may, of course, be other gods which refer to the activities of the group as a whole.

5. Individual polytheistic sects, under a supreme god. There is usually a hierarchy of separate gods, each of which has specific relations to the others, as, for example, in the early Olympian pantheon of Greece and that of India.

6. One supreme god which all worship, and in addition local spirits, saints, etc., associated with specific places or activities, such as healing specific ailments, or with special occupations. Nevertheless these local or occupational spirits will be closely linked in some way with the supreme deity.

For example, North African Mohammedanism has such local shrines as that of Mulay Yakoub, outside of Meknes, where the ill go to sulphur springs to be cured by the blessing of the Saint Mulay Yakoub (Our Master Jacob), who derived his power from Allah. In Europe, we have Lourdes and Saint Christopher for healing and travel, both under the supreme God of Christianity.

7. One supreme, monotheistic god, without local shrines or specialized saints, exemplified by the stricter sects of Christianity, Islam, and Buddhism. Within such systems there may be many schisms and sects, as long as all preserve the monotheistic principle.

In most of the more complex societies, polytheistic and monotheistic sects exist side by side; in Christianity, for example, strict monotheism is practically limited to the Unitarians and Universalists. Monotheistic systems maintain the hierarchical principle by their emphasis on great teachers, who in another system might be saints or departmental gods.

These levels of complexity, the distribution of which we have plotted on Map 6, do not necessarily represent a chronological system, since no evidence exists which would enable one to work out such a sequence with any certainty. From the point of view of the complexity of the systems, however, the criteria of interaction enable us to make a sequence arranged in degrees of complexity. It must be pointed out, however, that within any society groups will be found who represent all degrees of complexity, from the simplest type on. These exist contemporaneously in a society, often among people who speak the same language and habitually interact with one another. This is particularly true in a place like Europe, where peasant and folk cultures exist side by side with individuals organized into a complex system. In some cases, as in Ireland, the very simple type of organization of the rural farmer is associated with a complex, hierarchical institution, like the church or the state. In such a case, any attempt at classification of this sort merely confuses the issue, but as a means of describing societies which are still autonomous, or were so at the time of description, it provides a useful method of classifying the progressive development of society from a simple to a complex state. Only in this sense will we use this classification. Where the consolidation of groups has gone on as it has in Europe and in many parts of the East, the super-position of a hierarchically organized world-embracing religious institution produces interrelationships which cannot be regarded merely from the standpoint of the adjustment of a society within the limits of normal change.

It is for these reasons and for others to be stated shortly that the distribution of our seven stages of complexity in ritual symbols does not ex-

actly parallel the distribution of the stages of institutional complexity, shown on Map 5. The other reasons are that we have not enough information to plot these distributions accurately, and that we cannot be sure, at our present state of knowledge, that the criteria which we have used are exactly parallel.

Sacred Myths. Under certain circumstances many ritual symbols have associated with them sacred myths, or narratives which explain what the relation is between the symbol and the people, or rather what the rationalization of this relationship is. These sacred myths belong to an institution or group of institutions, and represent very closely the sequence of techniques within a ceremony, and are thus directly associated with ritual activity.

An example which can be illustrated briefly is the so-called Kuksu rite practiced in some tribes in central California.[2] This is a Rite of Passage in which boys are initiated at the time of puberty. There is a special earth lodge with a smoke-hole at the top. Boys are brought into the lodge and various dances are performed by members. Finally, the boys are taken to the roof of the lodge, one by one, and held over the smoke-hole so that the boy's abdomen is held over the opening. A dancer impersonating the god Kuksu shoots an arrow, so fixed that it cannot penetrate more than a half an inch, into the flesh of each in turn. After this, the boys are brought down, their wounds rubbed with herbs, and they are made to lie about in the lodge for several weeks, undergoing food restrictions and receiving advice from their elders.

So far, this is a more or less typical Rite of Passage. The mark made on the boys by the arrow is comparable to the scarifications made in the Poro Society, as described in Chapter 20. However, this procedure is rationalized by a myth, which is, in short, that the god Kuksu comes at intervals from over the sea, makes himself known to men, and marks his people with his special mark, the arrow wound in the abdomen. After this he goes back whence he came. He is said to have done this originally at some time in the mythical past, and hence comes back periodically to do it over again.

Ritual myths are best known from such simple societies as those found in Australia, Tierra del Fuego, and California. However, they may be found in all societies at any level of complexity. In Germany, for example, the Passion Play at Oberammergau is exactly such a ritual myth, serving as a Rite of Intensification. Pageants which purport to act out the exact sequence of events in an historical crisis may be included under this category, such as the acting out of the Landing of the Pilgrim Fathers at Plymouth, or

[2] Kroeber, A. L., *Handbook of the Indians of California,* Washington, 1925, Bull. 78, Bureau of Am. Ethnol.

the annual reconstruction of Paul Revere's ride from Boston to Lexington and Concord on the 19th of April. For our purposes it does not matter whether the ritual sequence follows an exact historical happening or not; from the standpoint of symbolization the principles are the same.

Myths represent ways of directing the habitual interactions of individuals in the Rites of Passage and Intensification, because they repeat in generalized form the elements of the ritual. When an informant, therefore, is commenting upon a myth, he gives its referent in the activities of the individuals participating in the ceremony. And on the other hand, when asked to explain the reasons for bits of ceremonial or ritual interaction, he ordinarily will refer to the myth and say that such-and-such is done because this other thing happened in the myth.

One caution, however, has to be placed upon the use of the word "myth." In many cases we speak of myths to refer to symbolic accounts of rituals and symbols which no longer refer to the actions of individuals in ceremonies. A good example is the mythology of ancient Greece, with which most children become acquainted, but which has no reference to the behavior of individuals at the present time. In other words, such meaning as it assumes for an individual is individual in character. It does not refer to the habitual interactions of individuals in an institution; as we shall mention once again in this chapter in more detail, only when the rites are practiced do the myths have meaning. The reader should be further cautioned to distinguish between true myths, whether living or extinct, and tales, which are told merely for amusement. The majority of texts of primitive literature collected by ethnologists, such as "how the woodpecker got his red head," etc., belong in this latter category. They are directly comparable to the stories which we tell after dinner parties or in smoking cars.

The Fluidity of Symbols. In our account of ritual symbols we have shown how they have become symbols of institutions or combinations of institutions, and how the process of symbolization brings about the linkage and equivalence of symbols through the development of tangent relations between institutions. The mechanism whereby changes in levels of symbols occur can be more easily understood if we recall the essential fluidity of symbols, their capacity for change and their assumption of new meanings. A few examples of this process will illustrate the significance of the differences of symbolic systems as a result of their dependence upon the equilibrium of societies.

A simple example of the changing importance of symbols is derived from the history of Mesopotamia. The historians studying the tablets which

describe the importance of various gods in Mesopotamia find a bewildering number whose importance seems to vary from period to period. Every town had its own deity, who was the god of the temple and of the village, and symbolized the activities of the hierarchy of priests and worshipers. At various stages, certain gods seem to become more important. For a considerable period of time the god Uelil, the center of whose worship was in Eridu, was important in the south, while Anu was the god of the north.

After the Semitic period began, the names of these gods were changed and their fortunes fluctuated more or less with the fortunes of their cities. In this period, a very minor god, Marduk, who had no important place in the mythology but had the fortune to be the patron deity of Babylon, began to be heard from. As Babylon grew more powerful, conquering more and more cities and extending its political hierarchy over the conquered communities, the religious hierarchy expanded with it, and when Babylon became the head of the Mesopotamia state, the god Marduk was the supreme god, and the priests and scholars accompanied his progression to supremacy by changing the accounts of the creation, etc., in the mythology, in order to allow Marduk to play the supreme role.

Another example of such changes comes from the Omaha. We have already referred to the fact that with the movement of the tribes into the Plains and the increased importance of buffalo hunting, the position of corn became less important than before, while that of the buffalo increased. Whereas the principal ceremonies had formerly been associated with corn, the change in the frequency of interaction and the importance of the hierarchy organized around these two techniques varied inversely. As a result many of the ceremonies associated with agriculture, particularly the subsidiary ones designed to keep birds and insects away from the fields, went completely out of use, and the major ceremony associated with the planting of the maize was performed immediately before the Ceremony of the Sacred White Buffalo Hide in the middle of the buffalo hunt, instead of in the spring as had been customary.

When such changes in interaction rates take place as the result of changing adaptations to the environment or to other changes in the organization of the society, symbols change their meaning, and very often old ones disappear and new ones come in. The change in position of the Sacred Corn Ceremony would serve as evidence of that, and an investigator unaware of its historical implications would have a difficult time determining why this ceremony occurred in the middle of the buffalo hunt. If we are to analyze symbols or the interactions themselves, we need good evidence as to the state of the system at consecutive periods of time. Only with this

kind of information are we able to make predictions as to the changes which are under way, or understand whether the changes that are going on represent oscillations within the limits of the equilibrium of the system or disturbances of sufficient intensity to necessitate a new equilibrium. In making historical studies by which such facts can be established, we are forced to rely for much of our evidence upon the analysis of symbols and to make the most probable guess after studying them as to how the underlying interactions have also changed.

III. SIGNIFICANCE

If we are to understand the effect of ritual symbols, we must reemphasize the part played in our experience by the workings of our body. In periods of change in our interaction rates, we subjectively experience simultaneous changes in our emotions, which, as we have seen, are controlled by the operation of the autonomic nervous system. When such a change takes place, the regular and almost mechanical processes of the autonomic nervous system are disturbed, and the organism undergoes profound physiological changes. It is these changes in the workings of the autonomic nervous system, described in Chapter 2, which we feel as emotion. As we have seen, these changes do not occur in vacuo, but are the result of stimuli from the environment.

The most important class of these stimuli includes those which result from our interactions with other people. These stimulus-response situations are more stable and more recurrent than any other type of situation by which we are influenced. From what we saw in the preceding chapter, it follows that the emotions so characteristic of our changing interaction rates may be symbolized by almost any symbol, and may be brought into operation by almost any technique. Nevertheless, these are fundamentally similar, whether we are dealing with the emotional experiences of an Australian Aborigine with his churinga, or with the experiences of the Hindu meditating on Brahma. The referents of these symbols may differ in the complexity and extent of the systems involved, but the emotional processes involve no differences in the activity of organisms. These emotional processes are as basic and as invariable as being born, growing ill, and dying.

Within religious institutions themselves, the habitual relation between a priest and the members of his congregation is symbolized by selected objects, idols, statues, beads, etc., which, through the conditioning process, stand for the relationship. In so doing, they refer not only to an overt sequence of activity between the priest and the members of the congregation but also to the particular emotional experiences of the individual brought

about by, or culminating in, this interaction. Since religious institutions are to a large degree concerned with restoring equilibrium of individuals in life crises, the emotional stress of such situations and the restoration of equilibrium through the repetition of habitual interactions results in the intensification of the symbolic significance of the object and the technique.

Where a hierarchical religious institution exists, symbols and techniques used in interactions within the institution are also commonly used in tangent institutions such as the family. Therefore, we find an extension of the symbol to another system of interactions and its significance becomes reinforced by its use in family ritual procedures as well as in the ritual of religious institutions. Thus the image of a god is habitually associated with daily worship in the family and this reinforces the technique and the symbol when the worshiper uses them later as a member of a religious institution in the context of that institution.

Basic to every such system, however, is the necessity of repetition, for once the habitual interaction is no longer frequently associated with the symbol, other symbols will take its place. And if the techniques are no longer practiced in the society, they lose their meaning in the religious institution. Thus in a very real sense, the existence of deities is dependent upon the practice of the ritual technique, and once this ritual technique is abandoned, the god or totem becomes extinct. Very often in such a process a new symbolic system may develop, once a certain stability has been attained in the habitual interactions of the members of the society, but in major disturbances of equilibrium, ritual systems are very often the first to suffer. At the beginning of such a period of disturbance, a marked increase in the interaction in the institution often occurs, but the requirements of practice necessitate either a modification of ritual symbols and techniques or their abandonment and the development of new systems.

An excellent example of this process is to be found in various parts of Europe with the gradual disintegration of the folk beliefs and rituals of the peasants, under the influence of state, churches, and the changing technological adjustment of European civilization. In Ireland, for example, as Arensberg has shown,[8] the social system of the rural communities was formerly symbolized by a complex system of ritual. This was dependent upon the changing family system, which involved a marked reduction in the frequency of origins of action by the old people once they had made the farm over to the son on his marriage. At this time they moved into the west room, and there lived in retirement until their death.

In his work on rural Ireland, Arensberg has shown how the beliefs

[8] Arensberg, C. M., *The Irish Countryman*, New York, 1937.

in the "good people" (the fairies) are the symbolic representations of the crises arising in agricultural existence, and of the compensatory activity of the farmer and his family consequent upon their changed relationship to the old people. It is believed, and the practices of the peasant Irish implement the belief, that the "good people" bless those who perform all their agricultural tasks correctly, keep the farm properly, and look after all their obligations. All those who transgress, that is, those who for any reason upset the habitual routine, will suffer misfortune: the milk will not churn properly, the cows will get sick, and trouble is bound to come. The ritual techniques, therefore, are derived from agricultural techniques and bridge each period of change. Even though the Catholic Church has opposed the practice of these ritual techniques and the holding of these beliefs, they have persisted in rural Ireland, and are only beginning at last to fall before the use of new techniques, such as modern dairy machinery, electric churns, etc., which bring about extensive changes in interaction through their use.

As the interactions in a society change, the ritual symbols and techniques also change, although in some cases hierarchical institutions which have a high frequency of origins of action are able to compensate for the decreased interactions in other systems. Nevertheless, as the complexity of a society increases and as the technology more and more stabilizes the routines, new systems of symbols come into existence. But even though they refer to different techniques and to different institutions, the necessity for stabilization of the habitual interactions of the individuals continues, and in the United States this is developing within the institutions themselves, where the Rites of Passage and the Rites of Intensification, in what often seems to be a very alien guise, are still practiced.

But this process of adjustment, in which a completely systematized symbolic procedure is developed, is a very slow one and moves with a differential rate. The direct parallel between a social system based upon techniques in actual operation and a system of ritual techniques and symbols is, as we said before, dependent upon changes in the social system. Where stable religious institutions exist, the tendency is for the symbols and techniques to remain constant, even though the meanings of the interactions of the individuals changes systematically. It often happens, therefore, as in later-day Rome, that the forms of the old religion will continue as a state religion despite such change. In imperial Rome this was maintained for a time, even though it had less and less relationship to the activities of the individual. Alongside it, however, there developed a spate of cults, including those of Mithra, Osiris and Christ, to name the most important. These were necessary because they referred to the lives of the

individuals in their several institutions. Of these, Christianity finally won out, and the old Roman forms were abandoned.

IV. PERSONAL VARIATIONS IN THE MEANING OF SYMBOLS

In every relation between specific persons, some part of the contexts of situation of the events becomes, by the process of repetition, the primary symbol of that relation. In many cases, not one but several symbols can serve this purpose. These symbols not only stand for the relations of people in specific systems, such as the family, but also refer to the character of the interaction between the persons in question. Thus the meaning of a girl's name to a love-stricken youth differs from the meaning of that name to the girl's mother or sister, or to her teacher. In other words, the name stands for the type of adjustment in the relations of two people, with its associated emotional context. In the same way, a symbol of an institution, like the American flag, takes on different meanings for different individuals, whose experience in the institution symbolized by the flag may differ widely.

In our account of the differences in the equilibrium of individuals, based on the differences in their adjustments within institutions, we have tried to show the wide variation in each individual's relations consequent upon variations in adjustment. It should, therefore, come as no surprise to the student to learn that the emotional connotations of symbols for individuals vary directly with the differences in their equilibrium. The devout person, the skeptic, the fanatic, are all to be looked at in the light of the stresses operating upon them, and even in the simplest societies, there are marked gradations in the degree to which the habitual interactions in institutions, or the routines resulting from crises, produce either a perfunctory compliance with the traditional or an unusual emotional experience in an individual.

SUMMARY

Ritual symbols, like ritual techniques, are derived from many contexts, and take many forms, such as the celestial bodies, places, objects, animals, persons, etc., as well as vague and abstract representations of human relations. Ritual symbols vary in concert with the levels of institutional complexity of societies. Ritual symbols of the simplest level include gods and spirits serving the society as a whole, and often represent changes in the weather; in more elaborate societies one finds special gods or spirits for special activities, as people begin to specialize through the division of labor, while in complex societies where all institutions are closely interrelated one finds a supreme god symbolizing the relations of the society as a whole.

In many complex societies symbols of different levels are employed side by side, just as people in the society differ in the complexity of their interaction in institutions. The great world religions, such as Christianity, Buddhism, and Islam, include among their personnel individuals who use symbols at most of these levels.

Ritual symbols change as the relations which they represent change. When a small tribe grows to be the ruling class in an empire, its private tribal god will become the supreme god of the empire; the mythology and ritual techniques will be altered to accommodate this change. As techniques change, symbols change also, but owing to the strength of the conditioning process there is often a time-lag between the change of techniques and relations and the resultant change in symbols, particularly when in some cases old symbols take on new meanings.

Symbols do not have the same meaning for everyone, nor do they evoke the same intensity of response in each individual. This is because all do not interact the same, and because the equilibrium of no two persons is identical.

PART V

Symbols and Human Relations (Continued)

CHAPTER 24

Language: Symbols and Techniques of Communication

I. INTRODUCTION

In Part IV we saw how, in certain fundamental situations, symbols serve as the stimuli to which individuals are conditioned to respond, and how they thus play an important and necessary part in human relations. A given symbol, however, does not act alone. Every symbol occurs in a context of situation, and it is thus dependent for its effect upon its associated and secondary symbols, as well as upon its position in the habitual pattern of interaction, which is the fundamental element in any context. Out of the symbol's position comes its "meaning," that is, its power of evoking responses of varying strengths from the individuals conditioned to it.

After examining the mechanisms of the conditioned response, through which symbols take on their meaning, we studied in Part IV the most important configuration of symbols to be found anywhere—important because it is associated with the greatest emotional changes in the individual. This symbolic configuration (the word "configuration" merely means a pattern or complex) is made up of the symbols and techniques constituting the rituals through which individuals and groups are restored to equilibrium after a crisis; it involves the habitual use of specific objects, words and gestures to which the individuals have already been conditioned in other contexts. It, therefore, represents not merely a combination of symbols which have meaning for one individual, but rather one which produces responses in a number of individuals. Otherwise, the *interaction* between groups of people, necessary to restore the equilibrium, could not come about.

Although we have already dealt with the most striking symbolic configuration of all—ritual—there are several others associated with particular interaction patterns which are important and deserve our consideration. These configurations, like ritual, include symbols and techniques. Again, as in the case of ritual, the symbols within these configurations become adjusted to one another in terms of the techniques involved. These configura-

tions are important in all societies because they provide much of the fabric of interaction within institutions, as well as between the members of different institutions.

In this section of the book we shall deal with six of these configurations: language, art, competition, money, law, science. There are others, but space does not permit a treatment of more. We shall also deal with them in less detail than in the case of ritual. Before we take them up in turn, however, we wish to make a few generalizations about them. In the first place, all of them, as the complexity of societies increases, produce specialists trained in the practice of their techniques, such as town criers, telephone operators, musicians, lawyers, professional athletes, bankers, and scientists. These specialists are directly comparable to specialists in technology, government, and ritual.

In the second place, in the more complex societies, as for example in our own, groups of these specialists become organized into separate institutions, such as telephone companies, theatrical companies, baseball teams, and law firms. Unlike ritual, however, these systems produce no separate class of institutions of their own. They are usually economic institutions, organized around the trader-client or commercial relationship, selling their services in the place of goods, as is also the case of institutions based on transportation. In some cases, however, they appear as sub-systems of political or religious institutions.

These institutions arise and develop in complexity in concert with the other kinds of institution which we have already studied; the same principles govern all alike. For this reason there is no need for a special study of them here; what we are interested in is rather to discover the logical schemes of the symbols and techniques of each of their basic configurations.

The first configuration we shall consider is language. Language is so widespread and so necessary to interaction that we do not ordinarily think of it as a symbolic configuration at all—at least, not in the same sense as ritual and art. Nevertheless it possesses the essential characteristic common to all symbolic configurations: a series of symbols and their associated techniques which have meanings held in common by a number of persons, even though there may be wide differences in the details of the referents for the different individuals concerned.

Each separate configuration—that is, each language—is a complex of symbols to which a group of individuals has learned to respond, and which have been segregated out of all the stimuli which the individuals in question have experienced. Since languages represent and depend upon separate societies, i.e., systems of individuals in equilibrium, they therefore

possess certain logical aspects which depend in turn upon the physiological properties of the individuals who make up these systems. These aspects are, in effect, logical categories by means of which, as we shall see presently, the configurations are organized.

Language is not only the most inclusive configuration of symbols of all those with which we have to deal, but it also provides, in a sense, the primary material out of which the other configurations are formed, since it is through language that almost all interaction takes place. Of all the configurations which we shall consider, language provides us with the best opportunity to observe the process by which people are conditioned to recognize a large number of symbolic elements as parts of a whole, because language can be most easily isolated from other configurations. At the same time we can observe how nearly the symbolic elements which make up such a configuration can in a single instance, in this case a single language, approach a logical uniformity.[1]

II. TECHNIQUES OF LANGUAGE

Most of the higher forms of animal life have some sort of apparatus with which they can make sound. Insects scrape their legs against wings, making them vibrate; amphibia, reptiles, birds, and mammals make noises by inhaling and exhaling air. Among reptiles the hissing sound produced by the rush of air suffices; among the other land vertebrates, however, from the tree toad to man, reed-like membranes in the larynx can be stretched by both involuntary and voluntary muscular action and made to vibrate when air is forced between them. The noises so produced vary greatly in pitch, loudness, and duration.

Variations in pitch depend on the tightness or looseness of the glottal cords, as the membranes are called; these variations based on age and sex differences may be found within a single species, as with man. The cry produced by a simple monotonous and unmodified vibration may serve as a symbol of the age or the sex of the individual to other animals of the same species. Thus when a female animal desiring sexual relations with a male cries out, any male within earshot can not only identify her as a nubile female but can also locate her. Furthermore, since females of the species in question utter such cries only in time of sexual activity, the male will become sexually stimulated when he hears them, just as Pavlov's dogs become gastronomically stimulated at the sound of a bell.

[1] It is to be noted that we are not dealing, in this chapter, with the "emotional" aspects of language. These have been dealt with in the chapters on ritual, art, and elsewhere, among other techniques used for the same end.

Variations in loudness are caused by the shape and size of the vocal apparatus, including the entire system of oral and nasal cavities from the glottal cords to the lips and nostrils. Some animals, such as the howler monkey, have enormously large resonance chambers caused by an overgrowth of the hyoid bone (Adam's apple), and lower jaw, and can make themselves heard for miles in thick forest. Others, like the gibbon, can produce the same effect by puffing out the walls of their cheeks and throats. Among human beings, powerful opera singers and mighty orators who can fill vast halls with their voices appear to have exceptionally large sinuses.[2]

Variations in the range of sounds which the organism can produce depend on two factors, the anatomy of the oral and nasal passages, and the delicacy of nervous control over the muscles involved. Most amphibia, birds, and sub-human mammals have little vocalic range. Many of them can make, or do make, but a single sound, over and over again; this is the case with amphibia, such as the tree toad or frog, and the symbolic value of their communications is limited to informing others of the same species of the sex, degree of maturity, and location of the sound maker. In birds and mammals, there is usually a vocabulary of anywhere from two to a dozen sounds which have specific meanings for other animals. Carpenter gives a list of nine each which he could recognize for the howling monkey and for the gibbon,[3] but states that, in the case of the howler, at least, there may be as many as twenty.

Human speech is produced by the same kind of apparatus as that which sends forth the cries of the lower animals. The cries of the latter, however, are instinctive—that is to say, the animal inherits the ability to make and to recognize them. All bullfrogs talk the same language, whether they live in California or in Siam. Among mammals, particularly monkeys and apes, conditioning is more of a factor but the vocal apparatus is much more limited than in man. The distinctive features of human speech are (1) its great variability, and (2) the fact that the ability to produce it and to respond to it is almost entirely acquired by conditioning.

The human hand, in the course of its evolution, served first as a forelimb for walking, then as a grasping apparatus for locomotion in trees, and finally as an all-purpose instrument for such varied activities as tool-making, writing, steering vehicles, and pulling down window shades. Similarly the human vocal apparatus has taken on highly complex activities—the glottal

[2] This has been observed by Dr. Leighton Johnson of Boston, who has made a specialty of operating on opera singers.

[3] Carpenter, C. R., *A Field Study of the Behavior and Social Relations of Howling Monkeys,* Baltimore, 1934; also *A Field Study of the Behavior and Social Relations of the Gibbon,* Baltimore, 1941.

cords were first evolved for the production of involuntary cries, the tongue as an aid to swallowing, the teeth for biting and chewing, the lips for grasping and moving food. All of these organs also serve, in combination, to produce speech.

Variations in sound are produced by the shape of the passages through which the breath escapes, by the degree to which the breath is impeded, by the position of the organs which so impede it, by alternately permitting the vocal cords to vibrate or lie slack, and by controlling the pitch of the vocal cords. Sounds produced by letting the air out unimpeded, with the glottal cords vibrating, are called vowels. The sound of the vowel is produced by the shape of the oral passages, this shape depending on the position of the tongue, teeth, and lips. *O* is made with the lips rounded, *A* with tongue and lips slightly drawn back.

Consonants are the sounds produced by impeding the passage of the breath. When the breath is completely impeded, as by a closure of the lips, by holding the tongue against the gums of the upper teeth or palate, or by closing the glottal cords tightly, a stopped consonant (b, p, t, d, k, g, etc.) results; when it is only partly impeded, sounds like f, v, w, l, and r result. In some cases either the tongue or the uvula may be trilled, as with various forms of r and gh. Some consonants are voiced (accompanied by a vibration of the glottal cords), others are unvoiced; in human speech, the cords are constantly being tightened and slackened. Some sounds are nasalized by the opening of the nasal passages, others not. There are other ways of modifying sounds by shifting the position of the larynx and other parts of the oral anatomy. Furthermore, sounds may be varied by a raising and lowering of pitch.

The range of sounds which the human vocal apparatus can produce is almost unlimited. Each language, however, makes use of anywhere from thirty to a hundred sounds which people conditioned to the use of that language can distinguish and which they can, with sufficient accuracy for recognition, reproduce. The sounds employed as symbolic elements in one language may differ from all or most of the sounds so employed in another. These represent what is called the "phonemic system" of a language, "phonemic" meaning sound elements. A person whose cortical motor areas are conditioned to the production of a certain group of symbolically meaningful sounds (phonemes) cannot readily train his lips, tongue, and other vocal organs to produce the new sounds satisfactorily unless he is quite young. Furthermore, his sense of hearing must be trained over again to distinguish between the elements of a new sound group, and this is often difficult. That is one reason why many immigrants in the United States

who arrived at an age of maturity may live here as much as fifty years without learning English, and why those who do learn it often speak with strong "accents." The ability of the individual to recondition his vocal and auditory apparatus to new sounds varies enormously, but decreases with age, that is, with the length of time the older habits have been in use.

III. TYPES OF LANGUAGE[4] (SYMBOLIC CONFIGURATIONS)

Human beings live in different environments, have different technologies, different institutions, and different symbols. A large part of the symbols of a people are included in their language. No one knows how many languages there are in the world, but there must be several thousand, if we use as a criterion the test of mutual comprehension. When two groups speak by means of symbols that others with a slightly different set of symbols can still understand, the difference is said to be one of dialect, not of language. Thus English is a language, Cockney and Cape Cod Yankee are dialects.

With so many languages now in existence, and countless others lost in the ebb and flow of linguistic diffusion, it is to be expected that every possible type of language will be represented. Every language, as was stated in the last section, has its own phonemic system; it has likewise its own way of building up those two units of communication, the word and the sentence.

The word may consist of one or more unit symbols, the sentence of one or more words. A unit symbol is a sound or combination of sounds habitually produced to signify a simple referent. The unit may be either radical or relational—that is, a radical symbol refers to a single object, action, or quality; a relational symbol expresses what we know as grammar, i.e., the relation between two or more radical symbols, or modifies the meaning of a radical symbol. For example: *dog* is a radical symbol; *leg* is another; in *dog's leg,* the *apostrophe s* is a relational symbol indicating the relation between *dog* and *leg*. Let us take the words *fish* and *fisher.* A fish is an aquatic animal; a fisher is a small mammal that eats fish, or a man that catches them. *Fish* is a radical symbol, *-er* a relational symbol.

Let us pause for a moment to consider the importance of these relational symbols to communication and hence to the regulation of human interaction.[5] In them may lie the distinction between language and mere vocal communication, like that of the higher primates. By use of linguistic symbols a man need not, like the apes, duplicate the entire experience of

[4] This section of the chapter is based largely on Sapir, E., *Language,* Harcourt Brace, New York, 1939.

[5] This and the following paragraph are largely the work of Prof. C. M. Arensberg.

the other animal who communicates with him. Howler monkeys, judging from Carpenter's evidence, can say "hep hep," or "run, there's danger," so that the communication will be understood and followed by action, but this is a direct use of single verbal symbols in a context of situation during the interaction. But as far as we can tell no animal can group together such symbols into a structure or configuration of symbols which make it possible to dispense with the duplication of the context of situation while the communication is in progress. In other words, it is unlikely that any ape or howler monkey could tell another ape or howler monkey about his experience in the quiet of the evening after the danger was over.

There are two principal reasons why this difference should exist, aside from the general paucity of symbols used by lower primates and the difference between the cortex of an ape and that of a man. One is the lack of relational symbols, as we have observed, and the other is the apparent inability of the ape, as compared to the man, to select symbols from the context of situation so that he can make the listener respond to a situation which he has never, in exact detail, experienced, although he may have experienced each of the symbolic elements of which it is composed.

The relations between symbols, which are known as grammar, may be expressed in the following ways: [6]

1. **By Word Order.** *The man ate the rabbit. Man* and *rabbit* are unadorned unit symbols. If the sentence read *The rabbit ate the man,* its whole meaning would be completely changed. Word order is of symbolic value in English, and is the most important grammatical process of our language. In some languages, however, it is of little if any consequence.

2. **By Composition.** This involves linking two or more radical symbols in one word. *Cowslip* and *charcoal* are English examples. In the former case, the flower thus designated has no visible relation to a cow, and the referent of *slip* may be either the action *to slip,* or *slip* in the sense of *a slip of paper.* The fact that the original meaning of slip is not clear to most people (including the authors) who use the word *cowslip,* shows that the composited word has a single referent as finite as either of the two from the symbols of which the word was first made. German is full of such words; German sentences literally translated into English sound heavy and ludicrous.

3. **By Affixing.** Affixing means tacking onto or into the unit symbol or combination of unit symbols some phonetic element which expresses relationship between units. Take the word *lucky,* for example. This consists of the radical symbol *luck,* meaning a condition, modified by the relational

[6] Sapir, *op. cit.,* pp. 64-85.

symbol *-y* which means "partaking of that condition." In the sentence, *"You are lucky,"* the relationship between the person *you* and the condition *luck* is thus expressed. The *-y* of *lucky* is meaningless when alone. Some affixes, however, can exist as separate words, for example, *with* of *withstand.* Such affixes are usually prepositions, i.e., words which are relational symbols whether alone or in combination.

Affixes may be prefixes (*with*stand), suffixes (luck*y*), or infixes (vi*n*co, Latin, in vi*n*co, vici, victus). Some languages express most of their relationships by means of affixes; Latin is an outstanding example. Others, such as Chinese, use none at all.

An affix may not only indicate the relationship between the radical unit and some other symbol in the same sentence, or even in the same word; it may also, like composition, shift the referent of the original symbol to something new. Thus a *catcher,* a person who catches balls in a baseball game, is just as basic and concrete as the action *to catch.*

4. By Internal Modification. In English we pluralize *goose* by changing the *oo* to *ee, geese.* We change the tense of many verbs in the same way; *sit, sat; catch, caught; shoot, shot; fight, fought,* are examples. In English, this type of modification is applied to relatively few roots; in some languages, such as Arabic, it is applied to most of them. *Katala,* for example, means *I kill; kutilu* means *I am killed.*

5. By Differences in Accent. In American-English usage, many words are verbs when stressed on one syllable, nouns when on another. For example, to *address'* a letter. What is your *ad'dress?* Shall we *invi'te* John? No, let's not give him an *in'vite.* Did they give you a *re'bate?* In English these meaningful shifts of stresses have not been approved by lexicographers, but they are nevertheless part of the language which millions of persons speak. In certain other languages they are not only official but an integral grammatical process, as in Spanish, for example.

In some languages, the actual pitch is important; if a syllable is pronounced with a rising pitch, it means one thing, if with a falling pitch, another. If it is high or low in relation to the speaker's normal voice level, it will have corresponding differences of meaning. In some languages, as in those of West Africa, as many as four levels are common; some languages distinguish six or eight. These pitch differences may signify not only relations between symbols, but also such modifications as that expressed by *-er* in *farmer.* Chinese, Navajo, and West African languages are examples of these which use pitch, usually, however, called "tone" by grammarians.

Two Kinds of Symbols. As we have seen, there are two kinds of symbols, radical or root symbols, which refer to persons, objects, actions, quali-

ties; and relational symbols, which either (a) modify root symbols to alter their reference, or (b) express the relation between two or more root symbols. The types of modification of meaning, or of relations, which relational symbols express, include:

1. Number: singular, dual, plural, etc. Affixing or internal modification (both are inflections) may be the method used in English: man, men; ox, oxen; horse, horses.

2. Sex: masculine, feminine, neuter.

3. State of Animation: whether animate or inanimate.

4. Basic Shape: whether round, long and narrow, cylindrical, etc. This is important in many American Indian languages, as in Navajo.

5. Time: not only past, present, and future, but immediate past, remote past, mythical past, completed or incompleted past, etc. In Australian languages, the mythical past is conceived of as continuing on and coexisting with the present and future. Special tenses can be created for special purposes—like the *ethnographic present* used by anthropologists.

6. Aspect: whether an action is momentary, durative, inceptive, cessative, etc., expressed in English as follows: "He just ——; he has been —ing for a long while; he began to——; he stopped —ing."

7. Mood: imperative, optative, subjunctive, etc. "Go! He would like to go. May he go? He goes."

8. Voice: active, passive, and reflexive. "I kill. I am killed. I kill myself."

9. Personal Distinctions: we may mean: the speaker and the listener; the speaker and someone else not present, etc. Some languages have different word forms to indicate these distinctions.

10. Source of Knowledge: inflection or other modification may indicate "I saw that . . . ; I heard that . . . ; my sense of smell tells me that . . . ; I think that . . ."

11. Possession or Ownership: the genitive indicates this in many languages. In English, it is expressed by either a genitive suffix (*'s*) or the preposition *of.*

12. Agentive: subject and object; nominative and accusative cases.

13. Locative: indicating place in which or toward which or away from which. Home*ward. Chez* in French. *—de* in Greek.

This list of types of relations which can be produced by the use of relational symbols is not exhaustive. No language uses all of these. Some languages are interested in the sex of referents, others in their shape, or their state of animation. Some are basically concerned with the time at which actions take place, others are more interested in whether the action has or has not been completed.

Theoretically, it should be possible to show how these types of relations are associated with the habitual activities of the people who use the language. Actually, however, the corpus of linguistic information available to the anthropologist is so organized that the task would be lengthy and difficult. One such study with Arabic, however, has been made by Worrell.[7]

In Arabic there are two genders, masculine and feminine. Worrell has shown that concrete nouns which symbolize large, strong, hard, or dangerous referents are usually masculine, while those with small, weak, and soft ones tend to be feminine. If Worrell is correct, this dichotomy clearly reflects the high interaction frequency of the male set in Arab society (see Chapter 12), which in turn is a reflection of the technological adjustment of the Arabs to their environment.

These types of relations, therefore, may be considered as alternative techniques of relating radical symbols to one another, just as fishing, agriculture, and animal husbandry are alternative techniques of getting a living. In the same way, there can be no gradation between them on the basis of relative complexity, any more than there is one between the three techniques of obtaining food just mentioned.

Sapir's Threefold Division. There is, however, one way of classifying languages which does seem to reflect a progressive development which is related to the growth of complexity in institutions. This is in the relative economy and flexibility of the means of using relational symbols. Among other ways in which Sapir classified languages was his threefold division into *analytic, synthetic, polysynthetic.*

> . . . the terms explain themselves. An analytic language is one that either does not combine concepts into single words at all (Chinese) or does so economically (English, French). In an analytic language the sentence is always of prime importance, the word of minor interest. In a synthetic language (Latin, Arabic, Finnish) the concepts cluster more thickly, the words are more richly chambered, but there is a tendency, on the whole, to keep the range of concrete significance in the single word down to a moderate compass. A polysynthetic language, as its name implies, is more than ordinarily synthetic. The elaboration of the word is extreme. Concepts which we should never dream of treating in a subordinate fashion are symbolized by derivational affixes or "symbolic" changes in the radical element, while the more abstract notions, including the syntactic relations, may also be conveyed by the word.[8]

[7] Worrell, W. H., *American Journal of Semitic Languages,* Vol. 41, 1920, p. 182. This phenomenon was first observed by C. Meinhof, in his *Die Sprachen der Hamiten* Hamburg, 1912.

[8] Sapir, E., *op. cit.,* pp. 135-136.

Sapir warns us that these are not qualitative categories, but classes based on the relative frequencies of quantitative variables. English, for example, "is only analytic in tendency. Relatively to French it is still fairly synthetic, at least in certain aspects."[9] These classes are, in other words, comparable to the categories which we have devised to express quantitative differences of complexity in regard to technologies, institutions, and ritual symbols, in Chapters 11, 18, and 23, and as shown on Maps 3, 5, and 6.

Sapir's list of languages which conform to these categories is highly instructive, particularly when amplified with a few more examples.

Analytic. Chinese, Annamite, Ewe (spoken by Negroes of the Gold Coast who have developed complex civilizations), Modern Tibetan, Polynesian, French, English, Ancient Egyptian,[10] Shilluk.[11]

Synthetic. Turkish, Finnish, Classical Tibetan, Arabic, Hebrew, Berber,[10] Modern German,[10] Anglo-Saxon,[10] Latin, Greek, Sanskrit, Bantu, Salinan (SW California), Takelma (SW Oregon), Sioux (qualified as mildly polysynthetic), Mayan,[10] Nahuatl (Aztec).[10]

Polysynthetic. Haida, Nootka (both on Northwest Coast), Chinook, Yana (Northern California), Australian,[10] Yaghan,[10] Bushman,[10] Algonkian, Athabascan,[10] Eskimo,[10] Chukchi.[10]

Hyper-polysynthetic. In addition to Sapir's three classes, one might postulate a fourth to accommodate Andamanese, the characteristics of which were revealed by E. H. Man[12] in his description of .bō̆ jig-ghī̆ ji-, a South Andaman dialect. This language might be called hyper-polysynthetic. It has prefixes, suffixes, and clusters of radical symbols of such complexity that a whole sentence is often expressed by a single word. Besides this, however, it has an abundance of inflectional forms, particularly in reference to the possessive personal pronouns. Man gives a partial list of over twenty ways of saying *my, thy, his,* etc. For example, *my* man is dī·a àbū·la-, *my head* is dōt chē·ta-. The form of the pronoun depends on the nature of the noun which it modifies. There is one form for words indicating the head, brain, scalp, neck, etc., another for those indicating the hand, finger, wrist,

[9] Sapir, E., *op. cit.*, p. 136, footnote 11.

[10] Languages not on Sapir's list.

[11] Sapir also calls Shilluk "symbolic," which Ewe apparently is not. Both belong to the so-called Sudano-Guinean family of languages. In Shilluk, relational symbols include changes of pitch or tone, a technique which Sapir classes with those of the polysynthetic languages (p. 136). In this way Shilluk, spoken by a tribe of relatively primitive Nilotic Negroes, differs from Ewe and Chinese, which are spoken by peoples with complex institutions. Its apparently anomalous position in this list is thus explained.

[12] Man, E. H., *The Aboriginal Inhabitants of the Andaman Islands,* London, 1882, pp. 49-56.

etc., others for various kinds of kinship relations, and so on almost ad infinitum. This may be compared to *meus, mea, meum* in Latin, with three forms dependent on gender alone, and with the English *my,* which has only one form, which cannot even be inflected. In view of this *lack of generalization,* we may venture to label Andamanese *particularistic.*

Language and Cultural Complexity. The point to this classification is that as the institutional organization of a people becomes increasingly complex, their language must become increasingly economical and simple in the ways in which radical symbols are related to one another. General rather than particular rules must be developed, and waste effort eliminated. This process has been historically observed; English has changed from mainly synthetic to mainly analytic, and so has Tibetan. Ancient Egyptian was largely analytic, although the other Hamitic languages were and still are synthetic.

The development of languages from a particularistic type, like the Andamanese, through polysynthetic and synthetic to analytic is, as we have just pointed out, associated with levels of cultural complexity. This development occurs for a very simple reason. As the referents become more numerous and more complex, vocabulary becomes greatly enlarged, and the uses to which single words are put become more numerous. In an analytic language, complex relationships which have newly arisen between institutions can be expressed easily and rapidly, without the need of changing or elaborating more than a few terms in each case; this would be a more cumbersome process in Aztec or German. The difficulties of trying to express modern scientific work in Andamanese, to take an extreme case, would be so great as to be almost unthinkable.

Besides this gradation in relational organization, languages also differ significantly, from our viewpoint, in the number of words in their vocabularies. In the languages of the simpler societies, unfortunately, we cannot be entirely sure of the sizes of the vocabularies, owing to the difficulties of recording. We can, nevertheless, get some idea of the overall range by comparing Australian languages, with some two to three thousand words each,[18] with English, which, according to Webster's New International Dictionary, has over 400,000.

Another way in which languages differ widely from one another is in the degree to which words are associated with particular techniques and particular institutions. An Australian aborigine, for example, may have over fifty wholly distinct words to represent family relationships; an Englishman may have fewer than twelve. The Australian vocabulary reflects the complex

[18] Elkin, A. P., *The Australian Aborigines,* Sydney, 1938, p. 13.

family system of the people; the English represents the simple structure of our family system. An Arab uses a single short word to designate a barren three-year-old female camel with brown spots on its shoulder; he is intimately concerned with camels, as we saw in Part II, and he needs a quick way to describe each variation. Thus the Arab vocabulary dealing with camels is enormously rich. We, on the other hand, have only one word for all kinds of camels, male and female, young and old, spotted and plain. The Arab, in contrast, has but one word for automobile, "tomobil." We distinguish between coupés and sedans, Buicks and Chryslers, and the list of names for various parts of an automobile fills a good-sized book. All this vocabulary has been built up during the last forty years with the rise in importance of this part of our technology.

Not only, therefore, can we distinguish between languages on the basis of size of vocabulary, but we can also learn a good deal about the society in which they are used by considering the internal distribution of words referring to institutions and technologies. Malinowski made this point in his first great contribution to the theory of language,[14] when he pointed out that the Trobrianders referred to all plants for which they had no technical use by a single word, "bush." In the realm of abstract ideas, particularly in matters dealing with scientific notions, the differences between languages are extraordinarily clear, but we shall discuss this in the chapter on science.

IV. FACTORS WHICH BRING ABOUT THE DEVELOPMENT AND DIFFERENTIATION OF LANGUAGE

Any group of individuals interacts continually in terms of its language. Although for many purposes, the use of words is not necessary when complex techniques or involved interactions must be referred to, vocal symbols are of great value; they provide ample opportunity for variation to fit a given behavioral context. Moreover, the conditioning of the activity (which may or may not be associated with gestural activity), makes it probable that almost all interaction involves the use of words. To a large extent, the words used do not matter, it is the timing of the interaction of the individuals which does. Anyone who doubts this can easily make a test. Let him faithfully write down every word that is used by some individual in the course of a day; he will find that the great majority of the words are trivial. Even two lovers, whom the poets would have us believe talk in highly elaborate

[14] Malinowski, B., "The Problem of Meaning in Primitive Languages," Supplement I in Ogden, C. K., and Richards, I. A., *The Meaning of Meaning,* New York, Harcourt, Brace, 1927.

symbols, repeat the same phrases over and over. Not what they say but how they say it is what matters.

The Language Barrier. Nevertheless, despite the fact that certain interaction patterns, such as love, are so universal that interaction can take place without either person being able to speak or understand the language of the other, the language barrier is one that most decisively separates groups. This is particularly true because of the importance of language in facilitating the execution of techniques; unless you know the names and uses of various parts of a sailing vessel, you will be of little help in a storm. And it is these techniques, particularly in trade, manufacturing and war, which tend to bring people together.

Language, therefore, is of first importance in relating individuals to one another. Either one group has to take over the language of the other, or some individuals must be bilingual. Where environment and technology bring individuals of different groups together, some modification of language habits has to be brought about. There are few areas in the world where the growth of technology and the development of economic, political and religious institutions has not radically altered the speech habits of the people.

On the simplest level, in such special environmental areas as Australia and Central California, a large number of languages existed side by side. In the former area, the wide variations in the food supply made groups wander over larger areas and thus come into contact with other groups. In this case, a gesture, or sign, language was developed similar to that of the Indians of the Great Plains. In California, the steady sufficiency of the food supply and the dependence upon simple gathering techniques brought about an almost unique situation. The average Indian seldom went more than ten miles from his birthplace, and there was little intercourse between villages. The result was that in aboriginal times there were dozens of languages in the area. The sign language is worthy of mention because it supplies a mechanism through which contiguous groups with different languages can interact without the usual spread of a language through the growth of institutions. It serves rather as a substitute for verbal language, in which all interaction is gestural. One individual makes signs and gestures with his hands and other parts of his anatomy, each gesture having a distinct meaning. By this means it is possible to dispense with verbal activity entirely, just as the deaf and dumb in our society communicate by a sign language. There are two regions in which the sign language has been highly developed, the American Plains and Australia.

Sign Language. On the Plains, the convergence of many different tribes, from the northern woodlands, the plateau country west of the Rockies, the dry Basin area, and the southeast, all within a very short historical period, brought many languages together. Since these Indians had at that time adopted the horse and were engaged in hunting the vast herds of buffalo, there was no fixity of tribal limits, and consequently one's neighbors were constantly changing. One could not hope to get along with a knowledge of one or two other languages; many others would be required. Under these conditions the sign language developed, and most of the Plains people learned it. A given gesture would symbolize a buffalo, another the act of walking, and so on. This language is still used; it is interesting to watch Indians employing it, with the listener from time to time interjecting a sign meaning "I understand, go on," and all the participants sometimes becoming as excited as if actual speech were being used.

In Australia, a sign language is used not only for communication between groups speaking different languages, for much the same reasons as on the Plains, but also within the group by any of its members who are living under a temporary ban of silence. Widows, for instance, are obliged in some tribes to hold all their conversations in this manner for a year or more. Many of them continue to communicate in this way once they are conditioned to it and never resume the use of normal speech.

The Spread of Languages. Except when an individual must learn a great number of languages to communicate effectively and so resorts to a sign language, the spread of languages depends upon the techniques and institutions which bring individuals speaking different languages together.

Economic institutions are the most important in this respect. For example, in pre-Columbian Mexico, Nahuan speaking traders from Mexico City (Nahuatl was the language spoken by the Aztecs) established colonies at various points along the western coast of Central America as far as Panama, and their activities helped spread the dominant tongue. In their case, trade extended farther afield than political influence. English has been widely spread by trade; millions of persons in Europe, Asia, Africa, and South America speak English as a second language. The same is true of Spanish; and, in Africa and large parts of Asia, of Arabic; in the Far East, of Chinese.

The languages above mentioned are common trade media because the people who speak them are great traders, but in other cases special trade languages develop, such as Beche de Mer in Melanesia, Petit Negre in French West Africa, and Chinook on the Northwest Coast. These are not normal languages at all, but languages created by and for trade, for the use

of people speaking different tongues. Beche de Mer, for example, is highly simplified and much altered English; Petit Negre is a form of Negroized French which the average Frenchman cannot immediately understand; Chinook is an American Indian language from which inflectional grammar has been eliminated. Swahili, the great trade language of East Africa, is a combination of Arabic and Bantu, grammatically simple, and spoken not only by traders and their customers but also by the natives of the Zanzibar region. The others, Beche de Mer, Petit Negre, and Trade Chinook, are spoken by no people as native languages, and, therefore, have no existence outside trading circles. In New Guinea, where there are many different Papuan languages crowded into small areas, natives from one tribe will speak Beche de Mer to those from another; this form of debased English does not require the presence of white men. Similarly in North Africa, Senegalese and Arabs may often be heard talking Petit Negre French to each other.

The expansion of political institutions has also done much to spread languages, but unless actual colonization takes place, old languages are often very tenacious. Even in the island of Great Britain, a strong political as well as economic unit, there are still three, English, Welsh, and Gaelic. In France, besides French there are Flemish, Basque, Provençal, and Breton. Switzerland, one of the world's most unified countries in many respects, and a strong political entity, has four languages (Italian, French, German, Romansch).

Missionaries, as well as governors and soldiers, are important spreaders of languages. In Polynesia and Melanesia, English has been widely disseminated by missionaries; in one New Guinea tribe, priests have taught their converts Latin. Literally hundreds of Albanians in the cities of Korça and Tirana have been taught English by a handful of American missionaries. Religious institutions which transcend national boundaries have to maintain lingua francas; church Latin is still spoken by many Catholic priests of different countries when they meet. As institutions cross national boundaries, and as means of communication and transport improve, the number of languages in widespread use is radically reduced; but within a language, whether it be English or Bantu, differentiations in vocabulary take place which reflect the special techniques and activities with which individuals are concerned.

Differences in Language. Within the family, for example, differences in the positions of individuals in the sets are expressed by differences in vocabulary, tone, and grammar. These differences are found not only in the way we address one other within the family system, but also between indi-

viduals occupying a common place in the system. Thus we use one group of words when we speak to children. We call a child "naughty," but we would not think of using the word seriously in reference to an adult. Similarly, two men use words dealing with sex and other intimate matters freely when with each other; they would not use them if women were present.

These differences, in some societies where the sets have a high frequency, may be developed into special languages. In Australia, the old men know the magical words of the sacred vocabulary of the rituals; these they keep secret until it is time to pass them on to their successors who in turn will keep them secret from those younger. The possession of such a special vocabulary intensifies the boundaries between old and young, increasing the interaction of the old among themselves and the young among themselves, and decreasing interaction between the two. Among some tribes where lip mutilation or tooth mutilation is practiced on one sex only, these operations make it difficult for the mutilated individuals to pronounce labial or dental consonants. In Africa, the Ubangi women, whose lips are pierced and enormously distended, cannot pronounce such labial stops as b and p.

In other regions, owing to the process of absorption or amalgamation of peoples, one often finds the men bilingual, the women not. In Morocco, most Berber men speak both Berber and Arabic; their women speak Berber only. This is due to the fact that the men interact in economic institutions where Arabic is necessary, while the women interact almost entirely in the family and local groups.

As we have already mentioned, groups practicing the same techniques in institutions develop special vocabularies often incomprehensible to the non-specialist. The conversation of lawyers, chemists or engineers is a good example, but this extends throughout many large institutions. Thus the members of the Western Electric Company use many words which are unknown to the layman, and they can talk in a professional slang without others understanding at all. This is because they can not only use technical electrical terms in their technical sense, but they can also use them to state any simple proposition through similes and circumlocution. This is equally true of many other professions and occupations.

In political and religious institutions, special languages are often in use, but these are ordinarily languages which were brought in by conquerors or missionaries. Norman terms still exist in legal usage; French was the court language of England long after the Norman Conquest. The Roman Catholic priest conducts his services in Latin; the Abyssinian priest prays in Geez, a dead language. These are not, therefore, comparable to the tech-

nical language of the economic institutions, though such technical languages may develop as the institutions develop in complexity.

Differences in language occur not only within institutions but also from region to region and community to community. These are the local dialects and the local ways of pronunciation and local vocabularies. With any kind of an ear, it is easy for an American to distinguish between Yankees, New Yorkers, Middle Westerners, and Southerners, and the discriminating can often spot with amazing accuracy the exact hamlet from which a man has come. These differences may become associated with sets in the institutions of a society; in this case they are automatic signals for orders of action. Thus, the English are conditioned to these differences through their class system, by which the Public School symbolizes origins, and the Cockney the terminator class in the political system. In Java, the noblemen speak Noko, the commoners, Kromo. Both nobles and commoners understand the other's language, and each uses the other's in addressing him.

The significance of these differences in language arising from differences in techniques and in the relationships of institutions lies in the part it plays in isolating members of systems or in facilitating interaction. We often hear complaints after a social evening: "So-and-so is so boring, all he can talk about is golf." To the golfer, the yachtsman or the baseball addict, endless technical discussion of their favorite subject is the very substance of interaction. To the uninitiated, it is relatively pointless. So, too, are the technical discussions of lawyers or doctors or scientists, or of two women discussing the clothes of a third.

We all love to "talk shop": that is, we like to use symbols which have the strongest referents emotionally. Ordinarily, these arise from the activities in which we have the most interaction, or which will provide us with our compensation against disturbances. We try to find others who have had the same experiences and who will respond with satisfying frequency to our use of the old familiar symbols. The golfer, after each round of golf, tells all and sundry the details of each shot, even though he may have been playing the same course regularly for twenty years. So, in the Andaman Islands, Radcliffe-Brown reports that in the evening, after eating, a man will get up before the fire and tell about a pig that he killed, and if the audience is responsive, he will go on killing pigs all evening.

Language, therefore, provides the symbolic means by which we can refer to events which have had significance for us, and through the interaction of speech, we are able to call back the interactions and activities of the past. Whether the language is technical, and hence what we might call a vocabulary language, or whether it represents a local dialect or a major

linguistic stock, people who have learned it and who symbolize all significant experience by its words, prefer to talk it rather than any other. The language thus serves to isolate the group speaking it from other groups, and the high frequency within the system produced by the linguistic barrier (since others do not understand it) in turn preserves the language. In this way such curious survivals as Basque and Welsh have come about, not merely through geographic isolation but also through an interactional separation from others outside the system defined by the use of the language.

V. EXTENSIONS OF LANGUAGE

Although language is the basic technique of communication, many peoples have devised other techniques which serve as extensions of language, by means of which the range of interaction between individuals and groups of individuals is enormously increased, with a resultant effect upon the complexity of the societies in question and the interrelation between tangent institutions. These include the sign language, which we have already discussed, writing, its further extension printing, the telegraph, the telephone, the phonograph, the talking cinema, and the radio. Of these writing has had the most profound influence to date upon the development of high rates of interaction within institutions and the development of institutional complexity and tangent relations.

Just as speech involves a complex relation between the vocal organs and the necessities of symbolization, so writing requires the relationship of graphic techniques to speech. Writing is a means of conveying meaning; it may involve a symbolic reproduction of speech or merely a symbolic representation of the referent itself. In the latter class comes picture writing, the predecessor of true writing as we employ it.

Picture Writing. Almost every people known employs or has employed some kind of picture writing or other similar mnemotic system. The Eskimo carves notches on tally sticks to keep track of the seals which he kills, and similar tally sticks have been found in Ice Age archaeological deposits. In Australia, a messenger will go from one tribal territory to another, to issue an invitation to the members of the tribe visited to come to a coroborree. The messenger's body is painted in such a way that all who see him will know who he is and what he is doing, hence his own body serves as the medium for communication. In his hand he carries a stick with various designs carved on it and several series of notches; this stick tells what kind of a ceremony is proposed, how many people should come, and how many days ahead it is scheduled.

The American Plains Indians used to paint elaborate series of con-

ventionalized scenes on buffalo robes and on their tipi covers; these were arranged like comic strips and told of an event of each year represented. Thus they formed historical records of their activities. The carving and painting of crests on door posts and totem poles by the Northwest Coast Indians served as symbols of the family history of the chief occupant of the house. These crests designated it as effectively as a bronze tablet would have done.

From painted buffalo robes and carved crests, it is not much of a jump to formal picture writing. By 3000 B.C., in the centers of Old World civilization, that is, the river valleys of the Nile, Tigris-Euphrates, and Indus, picture writing had not only begun but had progressed far along the path of conventionalization. Sumerian picture writing had already passed from the stage where the picture resembled the referent to that in which the symbol and its referent could be associated only by a process of learning. Furthermore, some of the symbols had ceased to represent specific objects and actions and actually stood for specific vocal sounds. Thus the transfer from a direct to a linguistic referent had been made.

The same is true in Egypt, where by the beginning of the Dynastic Period the scribes employed actual alphabetic symbols, syllabic symbols, and "determinatives," or symbols placed at the end of a word to show, in picture form, its meaning. For that reason, early Egyptian is easy to read; a given word may be spelled out both alphabetically and syllabically; if you recognize neither the alphabetic nor the syllabic characters, you can often tell the meaning from the determinatives which are pure picture writing.

The writing of the Indus civilization has not yet been analyzed sufficiently for final comment; it was replaced in the first millennium B.C. by the Sanskrit alphabet, just as the Egyptian was replaced by the Greek, and the Sumerian, which had been successively adopted and altered by Babylonians, Assyrians and Persians, by the Arabic. In China, probably about a thousand years later than in Mesopotamia, picture writing also developed and became formalized. The Chinese language, however, is phonetically and grammatically different from those of Egypt and Mesopotamia, and the stimulus to the invention or adoption of purely phonetic signs was lacking. The Chinese language consists of unit radical and relational words, without affixes, and without any other form of modification than that of pitch. The word order is the principal grammatical mechanism. Each character, therefore, represented a single word unit, either radical or relational, of invariable nature. As the Chinese expanded historically and as many local dialects developed, the same characters could be used for the same referents by people speaking any dialect. Today North Chinese and South Chinese are mu-

During the first millennium B.C., the Hebrews, Greeks, Romans, and others shifted from the tally system to the use of alphabetic symbols, as in the Roman numerals which we still use for many purposes. Our modern system of Arabic numerals came from India, presumably developed from a tally system. Place enumeration was begun with the abacus, some time during the first millennium A.D.; the zero, which is the key to the place system, and the sine qua non of mathematical symbolism, seems first to have been used during the eighth century, but whether it was invented in India, as commonly supposed, or elsewhere, has not been determined.[16]

In America, between the time of Christ and 600 A.D., the Mayas developed a place system with a zero, using units of twenty instead of ten and bars (5) and dots (1) in each place capsule.[17]

The Written Record. The importance of writing as a means of keeping records, and thus preserving a continuity between past and present time, must not be overlooked. Simple societies must rely on memory. In Australia, for example, it takes years for a man to learn all the tribal lore, which is largely historical; this he must pass on to younger men, who will memorize it in turn. As late as 800 A.D., in the Irish kingdoms, large colleges of druids, poets, and law-proclaimers spent as many as twenty years memorizing the complex system of Irish law and the vast body of Gaelic literature. Writing not only permits the accumulation of a much greater store of learning, but it is also a stabilizing influence. History, no matter how faithful the memorizer, tends to become mythical after being retold a few times. Ordinary events are soon miraculous, leaders soon become heroes, and before long deities. Writing retards this tendency and permits us to view past events and past personalities in a reasonably, if not wholly, accurate perspective.

Written historical records have facilitated the administration of complex institutions, notably in the case of trade. The oldest form of record we have is of trade transactions. In Sumeria, written records are largely commercial in nature; they either concern buying and selling and the accounts of property held by economic, political and religious institutions or are letters about such activities. Suitable types of records were also devised to show the relationship between expenditures and income. In the case of trade, the number of people involved in selling grain, bitumen, gold, or slaves made

[16] Smith, William Robertson, article "Numeral," *Encyclopaedia Britannica*, 13th edition, Volume 19, pp. 866-868.

[17] The second place unit was 18, the others 20. This irregularity was to make the total of two places 360, or the number of days of the year minus the intercalary days. The Maya numeral system thus was built around the calendar. The correlation of the Mayan and Gregorian calendars has not as yet been made in a way satisfactory to all the workers in this field; hence the uncertainty as to the initial date.

records necessary so that none of the transactions be forgotten. Another use of written records is for legal transactions when it is necessary to know the precise relationship of individuals in different institutions or within a single institution to one another. The importance of such records in maintaining the equilibrium of groups is obvious. If a five-year contract is drawn up without written record, the participants can argue endlessly, abetted by desire and faulty memory, and continual disturbances result. With written records of attested authenticity, there can be no argument. This explains the rapid development of writing in mercantile civilizations with complex hierarchical institutions, religious, economic and political. In Sumeria and Egypt it was most important to keep records of administrative details because of the complex irrigation system, large division of labor and the many far-flung trade operations of the merchant houses. Today in our own society it is even more important, particularly since the invention and elaboration of the techniques of printing, which permit the broadcast distribution of written material to whole populations.

The Symbolic Nature of Writing. But writing is a purely symbolic activity; it does not take the place of interaction. Although the symbols employed in writing may produce recognition in the reader, and hence a response low in intensity, they do not evoke responses which are not already operating within the organism. In other words, if a letter or a book has significance for an individual, it is because it reorganizes the relations of the *symbols* to the underlying referents to which the individual has already been conditioned. The act of reading anything, unlike the act of speaking the same words to an individual, does not involve interaction, although the symbols may be associated before or after with interaction. The letter is brought by the postman, the new novel is used as a source of conversation. Otherwise its contribution is solely on the symbolic level, as we shall see in later chapters. If a relationship between two lovers is after a time confined to letters, the relationship will gradually become extinguished in the Pavlovian sense unless it is reinforced by occasional interaction. This does not necessarily mean that the letter writing itself will become less frequent and finally stop, but this is very likely. The point is that the adjustment of the individuals disappears until finally, when they meet, they do so as strangers. They then have to learn to interact with one another all over again.

It is the memnotic aspect of writing and its derivative technique, printing, that is important. Only through its means are complex relationships of individuals possible, particularly those which involve highly synchronized actions of individuals widely separated in distant parts of the earth. It is as

a tool of the administrator, then, that writing is a fundamental technique. Without it, complex institutions of the type to which our economic and political institutions belong could not operate, and our complex adjustments to the environment would have to cease.

SUMMARY

Ritual, including a combination of symbols and techniques, is what is known as a *symbolic configuration.* Other symbolic configurations with which we shall deal include language, art, law, etc. Each of these has its techniques and symbols. Each configuration, as societies grow in institutional complexity, develops specialists trained in their practice, and in truly complex societies like our own, special institutions made up of these experts, like telephone companies, newspapers, theatrical companies, and law firms.

Of these different symbolic configurations, language is the most important since it is necessary for interaction. Each language is a separate configuration which is understood by, i.e., evokes responses from, a particular group of people who habitually interact together at a relatively high frequency.

Most of the higher forms of animal life have some apparatus by which they can make sound. In man it is a combination of the vocal cords, used by lower animals for involuntary cries, and the oral and nasal cavities, tongue, teeth, and lips, all of which organs have other uses as well. Among most lower animals these cries are involuntary and the same everywhere among a given species; they do not have languages. Among human beings, and to a lesser extent among monkeys and apes, sounds used in communication are learned through the conditioning process, and hence are not the same everywhere any more than are other techniques and symbols. Out of the possible sounds which can be made by the human vocal apparatus, from 30 to 100 will be selected for each language, as its phonemic system. These phonemes are learned in youth, and people who try to condition themselves to new systems at a mature age find it difficult or impossible; hence the strong "accents" which they cannot eliminate.

There are two kinds of symbols used by the technique of speech; each is made up of a combination of phonemes. (1) *Radical symbols,* which refer to single objects, actions, qualities, etc., and (2) *Relational symbols,* which provide the mechanism of grammar: i.e., which modify the meanings of radical symbols in order to show their relationships to each other. An ape can emit a cry that means "danger" to his fellows, but he cannot qualify that danger and tell when it is coming, through what agency, or from

what direction. A man can put symbols together indefinitely and express complex relations through language.

There are a number of techniques of using relational symbols, used in various combinations in different languages. Some are cumbersome and particularized, useful with certain classes of symbols only, some are repetitive, while others are more economical of effort and exhibit the characteristic of generalization, hence flexibility as new referents arise for symbolization. There is a definite progression between languages in this respect, and the more complex the society the simpler and more adaptable the grammatical process. At the same time the size of the vocabulary is also a function of the complexity of the techniques and institutions of a society.

People who live on simple technological and institutional levels tend to have a different language for each tribe; as political, economic, and religious institutions spread so that an increasing number of individuals interact in them, so do the languages spoken by their members, until one finds such world languages as English, Spanish, Chinese, Arabic, and Church Latin. On the other hand peoples like the Basques and Welsh, who interact in more or less isolation, tend to preserve archaic local languages as a means of reinforcing and symbolizing their isolation. Within societies speaking the same language, people who interact in specific institutions have a tendency to develop special vocabularies in terms of their techniques, such as sailor's talk and the jargon heard in a textile mill. In the same way members of different sex and age groups also have different ways of talking. In other words, the degree of specialization of language is a function of the interaction of those who speak it.

Besides speech itself language can be used by means of various techniques of extension, such as the sign language, telegraph, radio, and especially writing which makes it possible to keep exact records and is necessary for the development of elaborate institutions and societies.

CHAPTER 25

Art: Symbols and Techniques of Evoking Emotional Response

I. INTRODUCTION

As a result of the conditioning process, every group of people comes to develop a configuration of symbols, produced through specific techniques, by which they are able to differentiate between elements of the context of situation. These symbols, as we have seen in the last chapter, are collectively called words, and the configuration of symbols and techniques to which they belong is not confined to methods of designating events, i.e., to communication. It is also used in all other configurations, of which we have, in Part IV, considered the most extensive example, Ritual. We shall now deal with a third configuration which uses language as well as other symbols and techniques, and which has developed out of ritual, although in most if not all societies it also operates independently. This is *art,* and it is concerned primarily with the symbols and techniques of evoking emotional response.

In the preceding discussion, we have seen that during interaction there are periods, marked by changes in the interaction rates, in which there is heightened emotional activity. To a large extent, of course, these involve disturbances of the individual's equilibrium and activation of the sympathetic nervous system, but in many cases, the increase in interaction occurs in regular ways which have a stabilizing (and subjectively pleasurable) effect through the parasympathetic branch of the autonomic nervous system.

In the discussion which followed our analysis of situations producing religious leaders, in Chapter 16, we devoted some time to the techniques by which the religious leader is able to restore the equilibrium of the group. We pointed out that primarily this consisted of his ability to interact rhythmically in such a way that the disturbed individuals were adjusted in their interaction rates. This rhythmic interaction, involving a high degree of adjustment, seemed to bring the parasympathetic into dominance over the sympathetic coincidentally with the changes brought about in his interaction rate. It is this which stabilizes the equilibrium of the individual during the Rites of Passage and of Intensification.

Each ritual context was, however, made up of objects and actions in association with those objects, the whole making up the sequence of interactions forming the ceremony, and variations, both in objects and actions, were unavoidable. The object which represented a particular ritual symbol could be made of wood or stone or bone, and there was obviously ample opportunity for differences in the ability of the craftsman using the different materials. The actions might involve differences in the timing of verbal formulas, the rhythms might be accentuated by beating on a hollow log or by singing, and the gestures themselves might be exaggerated in accordance with the individual performers. From such differences in performance and manufacture arose the beginnings of art, namely, the variation of a symbol or a technique in such a way as to produce differences in response.

In other words, the differences resulting from individual variation produced differences in emotional response from the individuals, all of whom had been conditioned to respond to the symbol or technique in question. These differences were not merely differences in the individual's system of relations; rather they are demonstrable because the same individual under similar situations could be shown to react differently to the leader conducting the ritual with an extraordinary sense of timing, and to the poor leader, or to the object carved finely from jade or roughly from sandstone. As we shall see later, these differences are the product of properties of objects and actions which can be defined objectively, and which make up the subject of esthetics.

Once this capacity for differentiation of emotional response developed, it proceeded, within limits imposed by the technology, to be elaborated into complex symbolic configurations. Gradually, with the development of complex institutions, it freed itself from complete association with ritual, and became an independent complex with its own categories and its own techniques for the production of symbols. Before discussing this development, however, we must make a rapid survey of the techniques of art, in order to see the limitations imposed at different levels of complexity.

II. TECHNIQUES OF ART

The techniques of art can conveniently be divided into three major groups: (A) Art in Space, (B) Art in Time, (C) Art in Space and Time. This is the result of the elementary distinction between objects which make up the context of situation, and actions; although, as we shall see, this distinction is merely a guide-post to the early stages of the development of the arts.

A. Art in Space

1. Surface Decoration. There are two aspects to the decoration of surfaces: the use of design without color, and of design with it. Simple monochrome surface decoration may be accomplished by drawing or by painting in a single color, or it may be done by scratching the surface to be decorated.

Engraving, or surface-scratching, is an art technique of great antiquity. In Europe, it goes back to the Aurignacian period, during which Pleistocene artists engraved accurately realistic representations of horses, fish, and other food animals on bone and ivory. The earliest cave art, dating from the same period, was a process of scratching line representations of animals on the walls of caves with a flint tool known to archaeologists as a graver, or *burin*.

Among living and recently living primitive peoples, engraving is a common means of decoration. The Andamanese scratch cross-hatchings on their arrows and on their fiber basket rims; the Australian churinga is decorated by engraving. This is probably the most widespread single decorative technique, probably because it is the simplest and the easiest. The commonest designs so applied to objects are purely geometrical. Early pottery, in both the Old World and the New, is usually given surface decoration by engraving before the clay is rendered too hard by firing. Sticks, fingernails, and mollusc shells are the commonest engraving tools. Another simple way of producing a surface pattern is by wrapping the wet pot with cordage.

In our own civilization, engraving continues as a method of decorating objects, like silver and gold utensils, and as an important form of art in the manufacture of prints. The commonest varieties are engraving on stone (lithograph), on copper with the aid of acid (etching), without acid (dry point), on wood blocks, and on steel.

Drawing without making incisions is more perishable than engraving, and preserved archaeologically only under exceptional circumstances. The commonest substance used as a drawing medium is charcoal, available to everyone except lamp-burners like the Eskimo. Charcoal drawings on cliffs and cave interiors have been made by Palaeolithic Europeans, modern Australians, and American Indians; while in our civilization, it is a very common form of art technique used on paper, of course, as are pen and ink and pencil.

From charcoal drawing to painting is a very small step; Aurignacian man was acquainted with the use of color, and there is evidence that Neanderthal man was also.[1] The commonest color used is red, and this is derived,

[1] Through the discovery of lumps of prepared ocher in Mousterian and Aterian deposits.

among most primitive peoples, from concentrated deposits of hematite, an iron oxide. The list of peoples who use red ocher is practically a list of the peoples of the world. It is easier to name those who do not: These include the Eskimo; the forest Indians of South America, who use a red vegetable stain instead; modern Europeans; modern Chinese; and modern Americans.

Certain deposits of ocher yield a yellow substance, and thus three colors appear—black, red and yellow. Charcoal comes in a natural stick or lump form, but ocher requires preparation. It is ground to a fine powder, and then usually mixed with grease as a binder, and made into lumps the consistency of lipstick. A fourth color, white, can be provided by kaolin, or pipe-clay.

These four colors, black, red, yellow, and white, form the basic palette of peoples living under simple conditions of culture everywhere. These paints are applied to the human body, to weapons, containers, and other artifacts, as well as to stones and cliffs and the walls of caves.

Painting the human body is almost universal. It has the same symbolic function as clothing and the less common tattooing and scarification. The paint design used symbolizes the position of the individual in sex and age-grading, and it may also tell his class, if there are social classes, as in India. It may tell what he has just eaten, as in the case of the Andamanese, or his status in regard to associations based on valor in warfare, as among the Plains Indians. Indians who are on the warpath paint themselves in a certain way, to symbolize what they are doing, just as soldiers wear uniforms. Beads, pendants, bracelets, rings, and other such ornaments have similar uses.

Cave painting has reached a high point in two instances: the Palaeolithic cave paintings in the Pyrenees and in southern France, especially those in the cave at Altamira, Spain; and those made on cliff faces in South Africa by Bushmen. It has often been claimed that the European paintings were done in an attempt to insure success in hunting the animals depicted, but that is not certain. We know that in Australia, members of certain totems go to caves and cliffs associated with these totems and paint the symbolic figures on the walls, in order to increase their interaction as totem members with the referents of these figures, which are believed to control the abundance of game. We also know that the bull eland is a frequent subject of Bushman painting, and the bull eland was killed and dragged over the landscape by shamans in order to bring rain.

Painting with more than four colors is rare and may be taken as evidence of high artistic accomplishment. The Indians who made the Coclé pottery in Panama used seven, and their pottery is among the best ever produced in America. The Northwest Coast Indians made green from copper

salts, blue from a bluish clay, white from burnt shells, and brown from dried squid juice. They also made a green dye for woven spruce roots from fresh grass stain. Their unusual proficiency in obtaining the difficult colors at the higher end of the color scale is in accordance with the general technical perfection of their art.

In the more complex civilizations, the painting of pictures as such arises. Chinese painting and that of Renaissance Europe are examples, as are the Persian miniatures. In our own civilization, with the development of paint chemistry, a wide variety of painting techniques are possible, including oils, water colors, tempera, and so on.

A type of surface decoration which cannot be classified as painting is textile design. Textiles by their technical nature make the production of geometric designs obvious; most peoples who produce textiles weave such designs into them. Rarely, however, do realistic designs develop, since these imply a high degree of technical skill and a change of emphasis in the technical process from weaving as such to decoration. The Indians of the Northwest Coast produced, with great technical skill, realistic textile designs, and so did the coastal Peruvians. In the Old World, complex and realistic textile designs are confined to China, India, Persia, and Europe, with tapestries and rugs as the principal mediums.

Before leaving the subject of surface decoration, a few words must be said about the techniques of composition and perspective. Both are lacking in early art. The European cave paintings of animals show no composition, and the engravings give rare evidence of it. In the late Palaeolithic paintings in Spain, which show human figures, there is some attempt to indicate spatial relations between individuals in processions, but such attempts are rare and sporadic. Modern Bushman painting, on the other hand, frequently shows composition. The only evidence of the use of perspective in early art is the practice of the Egyptians, the Babylonians and the Maya in making some figures larger than others, but the size differential was merely a way of expressing relative social importance.

2. Sculpture. Sculpture is probably as old as surface decoration. In fact it is difficult to determine where a deeply scratched line ceases to be surface ornamentation and takes on the aspect of relief. In Europe, sculpture goes back to the Aurignacian, like painting; here, sculpture in the full round, as well as in relief, has been found by archaeologists. Despite its age, however, it is not, like painting, universal; many peoples make no use of sculpture at all.

The materials used in sculpture include stone, bone, wood, ivory, clay,

and metal. Clay may be used for modeling or for molding; the latter is usually late and implies mass production.

Two principal areas in which sculpture in the round is the characteristic art form are Negro Africa and Melanesia. In Negro Africa, wood, ivory, and metal are the principal mediums. The technique is a realistic representation of the human figure in which color is unimportant, since all are uniformly brown, except in the case of ivory; but surface texture is supremely important; a rich, glossy, smooth surface is one of the chief attributes of this sculpture. African figures are stylized, as a rule, in pose and expression, but individual variations are expressed by subtle differences in a few facial features; this is especially true of the elaborate masks so characteristic of West African art. Melanesian and Papuan carving is as a rule even more conventionalized.

Pottery as a medium for sculpture is the specialty of the coastal cultures of Peru, particularly of the Chimu, whose portrait jars are extremely lifelike in detail, while making little use of color. Stone carving was the medium of the Maya, the Egyptians, the Babylonians, and the Greeks. The Chinese have long specialized in jade carving, an art also developed by the Maori and the Mexicans. Some of the Mexicans, including the Zapotec and Mixtec, actually carved realistic figures out of quartz crystal.

Clay modeling is as old as sculpture, if we are to judge by the clay bisons found in a Pyrenean cave by the Comte de Bégouin. Many primitive peoples model clay figurines of animals and men, as do the Hottentots. In Central America, the manufacture of figurines was apparently an important industry as far back as the time of Christ; many of these were mass-produced from molds, and Egyptian ushabti were also made in molds by the thousands. Most of them represent the female figure, and it has been supposed, without adequate evidence, that they also represented fertility.

An advanced ramification of sculpture is the grouping of figures in composition. This is common in the bas-reliefs of Central America, Egypt and Mesopotamia. Groups in the round occur on Chinese pottery, in the Benin bronzes, and other West African metalwork, and in Greek sculpture.

B. Art in Time

1. Rhythm. Rhythm, the orderly repetition of a sound or motion, obtains universal response from human beings, and can also be made to affect some of the lower animals. The methods by which rhythm is produced and the degree of accuracy and complexity, however, vary greatly. The Australian produces rhythm by beating two polished, xylophonic sticks together at intervals. The Andamanese jumps on a sounding board, a flat piece of

wood set over a hollow in the ground. Similar devices were used in southern California. Common rhythm-producers are rattles, which may be made of seed pods with their dried seeds loose inside, as in Africa, or tortoise shells with small pebbles inside, as in North America. The Spanish castanets are also rhythm-makers.

The foremost rhythm instrument of the world, however, is the drum. Drums were used by most American Indians; only a few, such as the Fuegians and the Seri, lacked them. The Micmac, in the Canadian Maritime Provinces, used instead a roll of birch bark. All over Siberia, and throughout most of the rest of Asia, the drum was much in evidence; it is also ancient in Europe. The drums of the American Indians, and of the Siberians and Central Asiatics, were used mostly in religious ceremonies, as devices for summoning the spirits to the shaman. The greatest center of drum-using in the world, however, is Africa; here the drum is used to beat out the dance, as the primary instrument in ceremonies of all kinds. In West Africa, expert orchestras of drummers can play as many as six instruments at once, each with a different rhythm, and with the separate rhythms so imbricated that they produce in concert a complex pattern.[2] The drum when effectively used can produce high excitement; it is doubtful if anyone could ignore African drum rhythm, whether his reaction were agreeable or otherwise.

2. Music. One might say, without too much inaccuracy, that music is to rhythm what painting is to design; music adds the element of variation on the scale of pitch, just as the use of color adds variation to drawing and sculpture. Music does for the ear what color does for the eye.

Music may be produced either vocally or instrumentally. Anyone with the proper anatomical and physiological equipment can be taught to sing, and hence one would expect that singing would be much more advanced than instrumental music among the most primitive peoples. Such is not, however, the case. The Australian starts on a high note and sings a line; then he sings a line on the next note down, and so on, until he has reached the bottom limits of his vocal cords, at which time the song is usually at an end in any case. The native Arab of the Hadhramaut, on the other hand, has a range of two or, at the most, three notes, which he repeats constantly. Really complex singing is not found among primitive peoples. The Polynesians and the African Negroes, who must be considered relatively advanced in civilization, had part singing with a reasonable range of pitch.

Instrumental music depends, of course, upon the technical ability of a

[2] Records of such performances recorded by Mrs. Laura Bolton and produced by the Victor Record Company are on sale at music stores.

people to produce instruments. In the New World, aside from rhythm instruments, there was little better than a simple flute. Despite their high attainments in other fields, the Peruvian and Central American Indians did not apparently progress far in music. In the Old World, both wind instruments and stringed instruments developed early in China and in Mesopotamia and Egypt; in modern Negro Africa, many different kinds of harps and lyres are used which remind one of ancient Egypt. India, too, was an early center of advanced instrumental music.

There are almost as many scales as there are kinds of music: the Chinese scale, the Arab scale, and our own Occidental scale are three of the most important examples. The ear of the listener becomes conditioned to a certain scale, and to hear music played in another may cause acute displeasure. Many Europeans consider Arab music no better than the tuning-up period at the beginning of a concert; to an Arab, however, it has strong emotional connotations. There are some types of Spanish music which use modifications of the Arab scale.

3. Literature. Literature, with its branches, poetry and story telling, develops out of interaction, but it depends for its effect not upon gesture but solely upon the rhythms of the interaction. Even when the poem or the tale is written down, the process of reading is a silent speaking, although, as in other arts, the symbols themselves, as we shall see, play an important part in combination with these rhythms. Nevertheless, the frame provided by language is the controlling factor. The mere speaking of the words, "Mary had a little lamb; its fleece was white as snow," in contrast to, "When to the sessions of sweet silent thought, I summon up remembrance of things past," indicates how this rhythm is provided by the structure of language. But even within this framework, the speaking rate is of importance. The flair for timing makes all the difference between the success which greets the story of "The Golden Arm," referred to in Chapter 3, and its dismal failure. The art of literature involves the construction of a poem or a tale which possesses these rhythmic elements, and then the use of them by the speaker within the limits of adjustment of a given audience. In the composition of a drama, the additional factor of movement has to be taken into consideration. The writer must know not only how it will sound but also how it will look. To a certain degree, this is true of all literary forms.

Just as the dance with its rhythm provides an easy medium for the conduct of lengthy ritual, so the verse forms of poetry, with their rhythm, provide a vehicle for the memorizing of lengthy epic narratives. It would be very difficult to memorize Homer if his writings were in prose; the *Kalevala,* the *Nibelungenlied,* and other epics which require hours and

even days to recite would be almost impossible to remember otherwise. The ancient Irish jurists recited their oral laws in verse; the verse form not only made it easier for them to remember the laws, but also insured them against alteration, since it would be more difficult to make a substitution in poetry than in prose.

Poetry is seldom used alone, for its own sake; it is usually incorporated into ritual. Prayers are often in verse, and verse is often put to music. Poetry, being by nature rhythmic, naturally accompanies dance and song.

In some languages, poetic composition is easier than in others. Galla, for example, with a natural alternation of consonants and vowels, falls into meter easily; so does Bantu, with its principle of consonantal harmony. Arabic, with its regularity of inflectional endings, can be easily made into rhyming couplets; there is a tradition in Arabia of whole tribes that talk always in rhyme.

The telling of tales, as apart from poetry, is also a universal art medium, but the degree of elaboration differs widely. Among most of the simplest food-gatherers, the mythology is scanty; among people like the Vedda, the Andamanese, and the Ona, for example, the tales consist of a few explanatory myths to account for the appearance of the landscape, and little more. From this level, there is a gradual growth to vast mythologies, with lengthy tales of the adventures of legendary heroes, such as one finds among the Indians of California, and in Australia. In these places, the tale-tellers may build up a complete symbolic world, like the Alcheringa-world of the Australians, which has its roots in the past, but coexists with the present and future; a world similar to the world of the people telling and hearing the tales, but more stimulating and in some way more desirable.

Out of this recitation of mythologies comes literature. *The Thousand and One Nights,* Aesop's *Fables,* and the fairy stories of the Grimm brothers are collections of tales which had their roots in oral folklore and which have been written down subsequently.

The question of the truth of tales is seldom of great importance. The field ethnologist often wonders whether the people who listen to simple folk tales, explaining how the robin got his red breast, or telling how Gluskapi, the Micmac culture hero, tied the stems of clay pipes together without breaking them, believe them or not. The point is that belief or disbelief is not the purpose of literature. All of us, primitive and "civilized," listen to tales and read books to be amused, to receive emotional stimuli. They afford a vehicle for interaction, or, when read alone, a substitute, and whether or not they are true makes little difference. The ethnologist's question is as irrelevant as if he inquired whether we believed the story of the

celebrated Jumping Frog of Calaveras County, or any after-dinner story we happen to hear.

C. Art in Space and Time

Not only are there art forms which involve variation in space or time to obtain emotional effects, but there are also those which involve variation in both these media. These, which are based on the actions of persons, become subject to similar artistic differentiations. They are all primarily developed out of the interaction of individuals in ritual; the first, the dance, is gestural, and the second, drama, involves both speech and gesture.

1. The Dance. The dance consists of the movement of individuals in accordance with a rhythm, which may be conveyed either through the postures of the body alone, or assisted by a drum, to which may be added other musical instruments. The movements may be limited to the plastic movements of the body, or they may include complex spatial relationships of a group of dancers.

The simplest dance figures are the ring dance, in which the dancers form a circle, or that in which the dancers are in lines either facing each other or facing in one direction. Usually there is a segregation of the sexes; the women may be in the inner ring, as among some South American Indians, or they may be in a separate line, or not dance at all, as among the Andamanese. The formation of elaborate figures, as in some European square dances or our own folk dances, is practiced in Polynesia, Africa, and a few other places, but is relatively uncommon. Ballroom dancing, in which couples move at will around the floor, is a modern European and American development which seems to have no parallel elsewhere.

The most complex development of the dance form is to be found in the elaboration of what on the primitive level may be called mimetic dancing. It involves the use of gestures as the element of art, and the dance then consists of a sequence of postural movements which produce emotional responses. Postural dancing may be combined with figure dancing as in the modern ballet, or it may be limited to the solo performance. Most hunting peoples have some dances in which they mimic the hunting and killing of game. In doing this, they make elaborate imitations of the animals, which are often astonishingly realistic. Bushmen, Australians, California Indians, and other drylands hunters were very adept at this type of performance.

In almost every group, the dance is of considerable importance. The Andamanese, the African Bushmen, and the Vedda dance nearly every night, and it forms the chief form of group interaction. Dances are prob-

ably the most important single technique in ritual among American Indians, Australians, and most African peoples. In the Bible, we are told that David danced before the Ark. Coptic priests still dance at Christian religious ceremonies in Ethiopia. In our society, aside from the extensive use of ballroom dancing and country square dancing, one highly stylized form of the dance is notable and is used for almost every ritual. This is the parade, which is an element in all dance figures, although we may not ordinarily think of it as a dance form.

2. The Drama. Just as in the case of the dance, the drama is a fundamental element in ritual. It consists of the interaction of individuals, including both speech and gesture, in which artistic elements derive from the emotional response secured in the timing of the interaction, as well as from the symbolic material used. The drama in some instances is based upon religious symbolism and ritual; in other cases, primarily in modern complex societies, it uses literature as a vehicle. In any case, its object is to obtain increased emotional response within a given framework by the control of timing in the interaction.

Drama also involves the combination of other arts. It may include painting in the scenery, and in the costumes and masks; and sculpture and decoration. Musical accompaniments, either through instruments or singing, and dancing, may be included within it. Thus drama involves the widest appeal to the emotions, through the senses of sight and hearing, and through the employment of all possible spatial and temporal dimensions.

An Australian Increase Ceremony represents the simplest form of the drama. In the Witchetty Grub Ceremony, as we have seen in Chapter 21, the participants employed the art media of painting, music, literature, and the acting out of symbolic procedures. It is the *acting* part of it that made it drama, that is, the capacity for individual variation in the emotional effectiveness of the performance.

From a drama of this kind to the modern variety is a step which involves not so much complexity as unity of purpose. Our drama concentrates on the narrative aspect; the acting out of situations, with appropriate conversation, is its main feature. However, the Greek drama, from which it developed, makes much use of choral work and dancing, and we have preserved this alternate form in musical comedy and the opera. The use of masks by Eugene O'Neill in *The Great God Brown* was a return not only to the Greek stage, but to the whole world of primitive ceremony. The Balinese and the Chinese dramas, which are also highly evolved art mediums, continue the use of masks.

Primitive drama makes little if any use of stage properties other than costumes. In the Chinese theater, as in the theater of Shakespeare, this paucity of sets is continued; the building up of elaborate, realistic stage sets is a modern European and American development.

III. ESTHETICS: THE LOGIC OF EMOTIONAL RESPONSE

The learning of discrimination in emotional response between different presentations of the same symbol, is, as we indicated at the beginning of the chapter, the basic characteristic of art. Two sculptured representations of the goddess Venus, for example, will have quite different emotional effects on a single individual, even though the form of the symbol is the same. It is quite true, of course, that the symbol itself plays an important part in the total emotional response of the individual. Nevertheless, as we become more completely conditioned to discriminate between esthetic experiences, i.e., those which produce these emotional responses in us, we become more or less independent of the symbol itself, and as we shall see, we experience in the case of the abstractions of such a painter as Picasso, these sensory discriminations directly, without the intervention of any familiar symbols whatever. To do this, of course, requires a high degree of training, and for most of us, the crutch of familiarity is necessary to allow us to obtain a satisfactory response. We like to recognize the painting as representing a tree, even though the treatment is such that it represents no actual earthly tree but rather one distorted by the painter to produce a certain emotional effect. Still we can start off with the tree, just as in music a tune, that is, a repetitive theme which becomes familiar as the music develops, is a useful aid in obtaining a satisfying emotional response from the intricacies of harmony. In the next section of this chapter we shall occupy ourselves with this question of symbolism, but now we intend to take up those properties of the various art forms which produce in us these direct emotional responses.

In giving the brief sketches of the different art techniques, without, it is true, paying much attention to technique as the artist understands it, we classified them in accordance with certain properties, namely, Space and Time. To a limited degree, of course, these dimensions do play a part in the several art forms. In painting and sculpture, arrangements of space are fundamental to the effects produced, but these effects are dependent, especially in painting, upon other dimensions which are not ordinarily the concern of geometricians. These are objectively isolable dimensions which are characteristic of the art form itself. In painting, it is color; in music, pitch. These are measurable properties of the art forms in question, just

as space and time are measurable; together with certain differentiations which we shall make a little later, these form the dimensions of art.

Art in space, therefore, including engraving, painting and sculpture, is not purely geometrical, though spatial forms, particularly in sculpture, are of obvious importance. Nevertheless, even a geometrical figure is dependent upon color. Unless it were drawn in black against a white background, it could not be perceived. This type of art is thus more properly called spatio-color, and it is from variations on these dimensions that the effect is produced.

The properties of these dimensions are that they represent a serial order of extensions. The spatial elements are, of course, easily understood. There are three dimensions: length, breadth, and thickness, and the differences in combination of these dimensions give us all the shapes. Color is in the same way made up of dimensions. There is hue, which represents what we ordinarily call the color scale, the range from yellow to orange to red and then to purple, to blue to green and back to violet. Each of these hues can be varied in terms of brightness, that is, on a scale from light to dark, and these differences are all familiar to us. Finally, each hue and each degree of brightness within a single hue can be varied by the saturation of the color, and these three dimensions of color—hue, brightness, and saturation, are combined then with the three spatial dimensions of length, breadth, and thickness.

In music, a similar series of serial orders can be distinguished. The most obvious of these is, of course, pitch, which gives us the notes of the scale. Each point on the pitch scale, that is, each note, is also varied in terms of loudness or softness, and also in terms of its timbre. Most important, however, besides pitch is duration, the length of time a note is held; from it we get the basic rhythms of music. These four orders together comprise the elements of musical structure. They are dimensions in the same sense as dimensions in geometry or in the color scale. They are all necessary to produce the sound. Without some degree of loudness, the note could not be heard, nor could it be heard unless it had a duration above the threshold of our consciousness. One other element of duration is important in music, as in terms of space it is important in painting. That is the interval between color elements or between sounds. Both of these have dimensional existence in terms of their respective measures of space and time, and both are important in permitting the perception of the artistic element involved.

In a way comparable to sculpture in space, literature represents in the time arts a concentration upon certain elements in this manifold of sound. In the reading of poetry or prose, the natural pitch scale is of little im-

portance, in so far as it represents the delimitation of definite points on the pitch scale. In other words, poetry or prose is not sung to notes; it is spoken, and pitch is an uncertain and highly variable element. Here, beat, the time dimension, is of much greater importance, just as in sculpture, the space dimensions are primary and color is secondary in significance.

In terms of this analysis, it is easy to see that both the dance and the drama represent combinations, in different proportions, of these fundamental dimensions. In the dance, there is a greater proportion of the space elements, as found in sculpture, combined with the time dimensions of music; the rhythms can be as effectively marked by the drum and a succession of gestures as by any further amplification of instruments. The drama, on the other hand, being in effect interaction, is much more complex, since it represents the musical characteristics of speech together with much more of the composition aspects of painting though the effect is, of course, three dimensional.

Within this dimensional framework, existing for each of the arts, certain combinations develop as unit systems through the effect of conditioning. The simplest way to illustrate this is to refer back to our brief discussion of scales; the basic structure of the western scale, in which our music is composed, presents easily understood differences from that used by the Arabs or the Chinese. On the basis of a given pitch scale or a given color scale, certain juxtapositions of sounds or of colors present combinations of stimuli which produce emotional responses in the individual. These are the result, not only of the technical limitations of a given art form (in painting, for example, that a full range of colors has only recently been available, or in music that many instruments have definite limitations to their capacities), but also of the internal logic of musical scales and palettes.

The effect of each position on the scale, Dominant as against Tonic, and so on, or deeply saturated red as against light unsaturated yellow, has different physiological effects upon us. So, combinations and juxtapositions of notes or colors produce different emotional responses which are dependent upon the basic categories of scales to which we are conditioned. There is, therefore, in art, as in language, a logic of combination on the basis of certain assumptions inherent in the chance of the conditioning process.

Certain combinations inherent in the Arab scale are the result of the initial definition of the system; different combinations result from the Western scale, and there is no reason why the same effect should be produced in an individual. This is due to the fact that, at bottom, the system of assumptions made in an art are felt emotionally. Unlike geometrical systems,

their logic is at basis a logic of emotion rather than of units of measurement to be applied to the surfaces of bodies. In other words, a geometrician finds the properties of Euclidian geometry useful for certain purposes, whereas for other purposes he may prefer to use a different system. His purposes are, however, not emotional, nor are the rules of development controlled by his emotional response to a particular representation. In art, however, it is the effectiveness of a particular combination in evoking its response which is the determining element in the selection of a chord, or a shading effect in a drawing. Both are logical, but they form different systems of symbolic configurations.

IV. SYMBOLS AND THEIR RELATIONSHIP TO ESTHETICS

In the course of our discussion of art, we have seen that with the exception of a few cases in modern times, most art depends for part of its effect upon the symbols it chooses. This is particularly true in the arts concerned with space, and space and time. In music, the simplicity of the dimensional system, composed only of pitch, timbre, duration and loudness, makes it possible to dispense with these aids in so far as they represent elements out of other contexts. In the words of musical criticism, most music is not program music, where sounds from the natural environment or social life become the basis for composition; bird calls, battle cries, and hunting calls have furnished most of the exceptions.

In painting, sculpture, literature, drama, and the dance, and also in architecture, which is a half-way house between technology and the arts in space, symbols have played an important part. To take a single period of great art, the early Renaissance, everyone knows that Christian symbolism provided the context for most painting and sculpture. The large number of paintings of the Holy Family from this period, not to mention the vast number painted since that time, provide an instructive example of the fact that the symbol is only incidental to the determination of esthetic effect. Many paintings of the Holy Family are considered great works of art, others are universally granted to be second-rate. In general, the distinction is based upon the factors which are esthetic in character; they depend upon combinations of space and color in such a way as to produce in the individual conditioned to the logical system of Western European art, a profound emotional effect, even though he may not obtain any emotional reaction from the ritual symbol in question.

The recognition of symbols, and the consequent emotional response, are purely relative matters. An Australian aborigine is emotional over his churinga, a crudely carved oval slab of slate or wood. He handles it af-

fectionately and rubs it with fat and ocher, two substances which to him are themselves highly symbolic. The churinga symbolizes to him his entire relationship with the spirit world, his ancestors, his country, his food, and his people. A Lapp, driving his reindeer along a snowy path, sings a simple song, repeating over and over again a sequence of two or three short, declarative sentences in which he describes the swift movement of his reindeer's hoofs, and the swirl of the snow. This song brings tears to his eyes, and to those of his kinsmen and neighbors who hear it; he uses it as an effective emotional stimulus in wooing his bride.

The Lapp would think little of the churinga, were he to see one; he would examine it for a moment to see if it were a natural or artificial product, and hand it back or throw it away. The Australian, were he to hear the song of the flying reindeer, even if it were translated, which would be almost impossible, would receive no emotional stimulus whatever from this sequence of sounds. Like the Lapp with the churinga, his only response, if any, would be curiosity. An American or an Englishman might appreciate the words of the Lapp song, because snow is familiar to us, and we know about reindeer; unless trained in anthropology, we would care little for the churinga except as an object of curiosity.

People do not appreciate one another's symbols unless they hold them in common, which may be the case if their civilizations are similar or if they have had much contact with each other. We appreciate Chinese art, partly because we know something about China. The extent to which we appreciate it depends to a certain extent upon the experience and education we have had in reference to things Chinese. These are instances, however, in which the symbols of one group will produce emotion in the individuals of another, because the symbols used have different referents in the second culture from those intended. A grotesque Maori carving may amuse us, arousing the emotion of laughter; to the Maori who carved it, its significance was quite solemn in nature.

But our capacity to respond emotionally to a given art form must be differentiated from our capacity to respond to a symbol. The mutual unintelligibility of churinga and reindeer song to Lapp and Australian respectively does not prevent them from making an esthetic judgment and an emotional response to the song and the carving themselves. That the degree of the response of each to his own symbol was dependent upon their separate experiences is not relevant to the consideration of the effectiveness of these particular expressions of an art.

In other words, we are all of us able to learn to understand different esthetic systems and to make emotional discriminations between different

representations of Maori or Chinese art. None of us, however, can hope to obtain an emotional approximation to the response to the symbols which was special to the Maori or the Chinese, because the significance of the particular god represented by the idol or the amulet is practically nothing to us. We can understand their referent in terms of the analysis of the interactions of the individual, but this is a scientific matter and not a matter of emotion. We can, however, isolate, after much experience, the objective assumptions in the art forms. We can work out, for ourselves, the scales peculiar to a group, and the logical steps by which they are developed, in the same way that we can learn to appreciate, emotionally, the complex structures of Bach and Beethoven or Renoir and Picasso. But this has to be done in terms of the combinations of esthetic units, and not in terms of any historical reconstructions as to what the painter or composer was "thinking of" when he made the composition. This can be well illustrated by reference to one distinction which is ordinarily used in histories of art, that between "conventionalism" and "realism."

In some forms of art, the referent of the symbol is obvious to any observer, whether he is conditioned to this form of symbolism or not. A Benin bronze head, for example, obviously represents not only a man but a particular man. The same is true of a Chimu portrait jug from the coast of Peru. The cross-hatching on the surface of Early Mesopotamian painted pottery does not represent anything; it seems to be an exercise in geometric balance and color harmony.

One must not, however, assume that no geometric art has symbolic reference; the case of Jibaro textiles is an example which disproves this.[8] The Jibaro men weave cloth in long strips on slanting, two-bar looms. The designs which they weave into the cloth are stripes of red, brown, black, and yellow. To the casual observer, this is just striped cloth, but to the Jibaro the different arrangements of stripes have definite meanings. A sequence of white, brown, black, brown, and white, repeated over and over again, is called *pigeon's eye,* because it represents the sequence across an eye from sclera to iris to pupil and back again. This cloth bears the same power as an amulet that a pigeon's eye would.

There are many stages in the conventionalization of symbols between the Benin heads and the Jibaro textiles. One of these is the famous system of the Northwest Coast Indians, by which they bend or adapt their sculptural design to the shape of the object being decorated, and make it clear what animal is meant by some special feature—two large incisor teeth for a beaver, a pair of tail-flukes for a whale, among others. All art symbols

[8] Karsten, R., *Headhunters of the Northwest Amazonas,* Helsinki, 1935.

are to some extent conventional, since all are subject to selection. Even the waxworks representations of Hitler, Mussolini, and Napoleon in Mme. Tussaud's gallery are conventional—the wax faces do not have pores to the skin. The borderline between realism and conventionalism comes at the point where a person who is familiar with the referent but not with the symbol fails to recognize its meaning at first glance. It is, therefore, entirely dependent upon the individual's knowledge of the referents. In some cultures, most art is realistic; in others it is mostly, if not entirely, conventional. The factors which produce this balance between the two extremes are linked partly with the degree of technical skill involved, and partly with the changing role of institutions in the society in question.

This institutional aspect of art is one which most needs to be considered in weighing the place of symbolism in esthetic expression. In groups in which the art forms are subsidiary to their ritual use, there is little differentiation as a means of obtaining emotional response, and the art is described as conventionalized. This results because the emotional response obtained through ritual is a highly conditioned product. Ordinarily it occurs in the stable and less complex societies. So-called realism, on the other hand, is the product of complex societies or of groups which have unstable equilibria. In that case, additional response is produced by the variation in art forms; in the stable groups, this is not necessary. It is no accident that religious revivals are associated with a decrease in artistic activity and that strait-laced groups, i.e., those who interact at a high frequency within the religious systems, are not fond of art.

The reason is that the symbols of a stable group tend to become fixed, and any change, such as that demanded by artistic expression, involves a minor disturbance. The arts flourish only when the system is unstable and complex, when variation in emotional response is the rule rather than the exception. In such times, the artist becomes of great importance. He provides through his products a means of obtaining emotional satisfaction outside the limits of the traditional systems of relations. For that reason, also, in such periods, the existing institutions use his products to reinforce their own systems of symbolic configurations. A high development of religious art is always correlated with the beginning of a period of disturbance in religious institutions.

At the present time we are witnessing a further development of symbolism in the field of art, as we have already mentioned. In this case, symbols are being selected much more from daily routines of existence and much less from the religious institutions. And in much of our present art forms, the symbolism employed is so completely personal that it has no

referents in the experience of others, and it has moved almost entirely onto what might be called an esthetic plane. Such a development, however, no matter how effective it is for the professional artist in providing him with new combinations and keys to combinations in his esthetic repertoire, does not have a comparable effect on the ordinary individual. Up to the present time, at least, it is safe to say that the symbol is a necessary point of departure for most individuals, even though more and more, the emotional response is being obtained from different esthetic combinations rather than from any special property of the symbols.

SUMMARY

Art is closely connected with ritual in all societies, but it also has an independent existence. The use of the symbols and techniques of art has a stabilizing and subjectively pleasurable effect on the parasympathetic nervous system, and thus it is useful in times of crisis when the sympathetic is aroused, in that it serves to restore equilibrium. People become conditioned to different art forms which can have this effect on them, but not necessarily on others who have been conditioned differently.

The techniques of art may be divided into (1) *Art in Space,* (2) *Art in Time,* and (3) *Art in Space and Time.* Art in space includes surface decoration which is two, and sculpture which is three, dimensional. Both may also, however, employ the medium of color, which includes three other dimensions; hue, saturation, and brightness. Art in time is based on rhythm, that is, upon alternations in duration of sounds and silences, and upon pitch, timbre, and loudness. Literature depends not only on the symbolic representation of interaction through language but also on rhythm. Verse, in which rhythm is highly developed, forms a relatively invariable art form which makes it easy to memorize. Literature varies from the simple explanatory myth of the most primitive food-gatherers to the modern novel. All these tales provide amusement, a vehicle or substitute for interaction. Whether or not they are true is of little or no importance in any society.

Art in space and time includes the dance and drama. Dancing is of considerable importance among all peoples, because of the ease with which it evokes responses, and is often associated with ritual. It is a combination of rhythm with posturing and spatial position. The drama is also a combination of other arts, but it includes literature and the spatial arts, especially in the use of masks. Most of the "primitive" forms of drama also include the dance and music.

All forms of art represent serial extensions on a number of different

dimensions. Within this dimensional framework for each of the arts, certain combinations develop as unit systems through the effect of conditioning. The Western, Arabic, and Chinese musical scales will serve as examples. The use of each sequence of positions on the scale has different physiological effects on us; the emotional responses are dependent on the basic categories of the scales to which we are conditioned.

The effectiveness of great art depends not on the symbol alone, but on the way it is employed. Thus a religious painting, if well done, will evoke a response from persons to whom the esthetics of the painting has meaning but not the subject. Esthetics, or the appreciation of art without reference to the overt meaning of the symbols, requires training and has never become general. Most people in every society require the symbol itself to evoke emotion. People do not appreciate each other's symbols unless they hold them in common, or unless they have borrowed or learned them, or unless the symbols have different referents in the two cultures.

Art varies on a scale from comparative realism at one end to geometric conventionalism on the other. Some geometric art appears to be merely an exercise in balance and color harmony, without specific referent, but often what appears to be a series of stripes, etc., turns out to have a specific meaning for the people who use it. The factors which produce this balance between two extremes are linked partly with the degree of technical skill involved, and partly with the changing role of institutions. Ordinarily, all else equal, conventional art occurs in the less complex and in the more stable societies, in which all can be conditioned to it. Realism, on the other hand, is more characteristic of unstable or changing societies. Thus it may be said that the degree of realism in art is an inverse function of the relative stability of the equilibrium of a society.

CHAPTER 26

Games and Warfare—Symbols and Techniques of Competition

I. INTRODUCTION

When children imitate the actions of their elders, shooting toy arrows from miniature bows, playing house, or pretending to drive automobiles, the performance of these symbolic representations of adult behavior conditions them for the techniques and symbols in terms of which they will later interact. In many cases, however, this play involves no imitation. It then becomes simply a form of activity not practiced by adults; for example, top spinning or sliding down icy hills on sleds. Children among all peoples play, both imitatively and otherwise. So do adults.

One important branch of play is the type of activity known as games. Games differ from other forms of play in one basic respect: games always take the form of competition between individuals or groups of individuals. Their primary purpose, therefore, is to bring about interaction between the persons or groups involved. Games, moreover, are conducted according to formal sequences of prescribed interaction, in which, within the limits of a specific technique, individuals originate to one another alternately, or one side tries to originate at a greater rate than, and tries to out-act, the other.

In their role of building up interaction, games resemble ritual. Often they may be used in Rites of Passage or Rites of Intensification. Nevertheless, they involve different symbolic areas; the game is concerned with an increase in the interaction rate in the relations of individuals whether or not there has been any disturbance of equilibrium, which, as we have seen, defines the ritual. When a game occurs in one of these rites, it is because it is a technique which brings about an increase in interaction (often between the members of different sub-systems) after the preliminary restoration of equilibrium. Conversely, a game may be started by a ritual, if the beginning of interaction requires a change in the frequencies of the interaction of the two groups.

One other general difference between games and rituals should be

pointed out. Ritual symbols and techniques are taken from the contexts of situation which make up the daily life of the individuals involved in a crisis. They represent conditioned responses, the performance of which stabilizes the interaction rates of the individuals concerned and their concomitant autonomic activity. Games, on the other hand, only occasionally use such symbols and techniques, and then only secondarily. A game of barroom darts, in which contestants throw sharp-pointed darts into circles on a marked board, could only be taken to symbolize hunting or warfare by a far-fetched stretch of the imagination. A game of tennis has not even the ghost of such a referent.

Within the framework provided by a given technique, a complex game may be developed which controls the interaction of the individuals taking part, and yet allows them opportunities for significant variation in their interaction rates. This is particularly true in those games where more than one person plays on a team, where teamwork requires synchronization of the interactions of a large number of persons, who in turn interact, in opposition, with the other side. American football is perhaps the most complex of all these games. The large number of plays, with assignments for each player, the coordinated blocking on the offense and tackling on the defense are too well known to require much explanation. Different styles of team-play indicate the wide variation possible on a fundamental pattern requiring precisely-timed synchronization.

It is to be noted that the game builds up high rates of interaction not only within the team and between teams, but also between the players and their audience. The responses of the spectators to the actions of the players afford a great extension of the range of the interaction. The roar of the crowd when one of the players on their team makes a long run is a familiar example of the way in which sports leaders originate in set events to their followers. Just as political leaders may compete against each other for leadership, so the conflict between two teams is a way in which the members of institutions are related to one another: the baseball teams of two factories, for instance, or of neighboring towns. The game canalizes potential conflict between opposing systems by bringing about interaction at a high frequency, but within the rhythmic order imposed by the techniques. It thus substitutes for conflict, which, as we have already seen, is the arhythmic failure to adjust within the interaction rates. The tremendous importance of games in our own society is due to the fact that they provide regular opportunities for interaction within habitual techniques, using well-known symbols, ordinarily learned in childhood, and thus provide a constant

framework in a society where changes in interaction rates are imposed by the technology and the institutions.

One further development arises when the competition becomes so intense that the game becomes lethal, and we have what we may properly call warfare. As we shall see, with few exceptions, largely during modern times, warfare among all peoples is conducted according to prescribed rules and is little different from a game such as football or lacrosse, except for the fact that the object is to incapacitate the members of the other side. The history of combat is one in which the primary purpose has been to fight in accordance with standard procedures and to defeat the other side. Killing the opponents was only incidental, and was only considered proper if it was done in an accepted way. The difference between a game and a war is primarily technological, with the exception that in some groups, and not by any means in all, winning a war enabled one to incorporate the conquered into the political system as terminators in the administrative set. In some cases, as we shall see, this occurred as the result of a game, and thus there is little fundamental difference between them.

II. THE TECHNIQUES OF GAMES

In this section we are concerned not with the relationship of games to institutions but with the techniques which they employ. These techniques may be classified in many ways. One basis of classification is the pattern of interaction followed. For example, in some games, one person or team plays while the other waits, and then the other person or team plays in return. In others, the contestants engage in action against each other simultaneously. A second basis for classification concerns the length of time in games. Some games last an allotted time, and whoever is ahead at the expiration of the time limit wins; others last indefinitely until a certain score has been attained.

A useful division based on technological factors which we shall follow here places all games in two contrasting categories, depending on the type of action. The two categories are *board games,* which require no more physical effort than that required to shuffle cards or shake dice, and *athletic games,* or *sports.*

1. Board Games. As far as one can determine, most of the truly primitive food-gathering peoples, such as the Andamanese, the Bushmen, the Fuegians, and the Australians, lack board games, although the Bushmen, like most American Indians, play the game of guessing which hand conceals a small object. The Seri of the Gulf of California, however, may be taken as an exception. The Seri board game is a dice game played by either two

persons or two groups of players. The dice are three flat pieces of cane, with one side green and the other black. One player throws up the dice and lets them land. If no insides (the dark sides) land up, he gains four. If one inside lands up, he gains one. If two insides land up, he loses one, and also loses the play. If three insides land up, he loses four, but does not lose the play. Thus one person, or one side, keeps the dice until a two is cast, or until the game is won.

The object of the game is to build up a score of +10. The first player marks his score on the ground by scratching strokes on his side of the marking place. If, however, he goes below zero, he erases his score from his own side and marks the minus numbers as pluses on his opponent's side. When the opponent gets the dice, the opponent will subtract his plus winnings from the first player's score, until he has reduced this to zero, and then mark plus scores on his own side, until he loses the dice or wins. Thus whenever one player wins, the score of his opponent is zero. If in the last cast, the winner goes over +10, he can keep the excess score as credit on the next game. This is a rather complex system of mathematical scoring for a people as simple culturally as the Seri.

A comparable game is *Abia,* played in the Cameroons by the Pangwe tribe of Bantu-speaking Negroes, and also, in variant forms, by many other Africans. Abia requires four or more players, and also a non-participant, a sort of croupier, to shake and throw the markers. The equipment consists of seven discs of wood, each of which has one rough and one smooth side, and a number of chips. The chips are half-shells of the pit of the fruit *Mimusops Congolensis* carved on the convex side in some specific design, such as a man, a snake, or a hoe. Each player carves his own chips, or, if unskilled, hires a friend to carve them for him. He keeps his chips until death, or until he has lost all of his property through gambling, and hence can gamble no more. In such an event he will sell them. Each man knows his own chips; the design carved on the back apparently helps him to identify them.[1]

The croupier places the seven discs in a basket, and one or more chips belonging to each of the players. If there are only three players, one man puts in extra chips as a dummy. The croupier tosses the chips up and down in the air in the basket, turns this quickly and slaps it on the ground upside down. At this point, the players make their bets, after which he removes the basket.

[1] This data on the game of Abia comes from Siegel, M., "The MacKenzie Collection, A Study of West African Carved Game Chips," Mem. Am. Anth. Society, No. 55, 1940. Siegel does not say what symbolic significance the designs on the backs of the chips have.

The scoring depends on the relationship of the discs to the chips. The rough side of the discs and the carved, or outer, side of the chips is called "right," while the smooth side of the discs or the uncarved side of the chips is called "wrong." If from 4 to 7 discs land wrong and only 1 chip is wrong, wrong wins; the cast is "wrong." If 4 to 7 discs are wrong and 2 or more chips also wrong, right wins. If 4 to 7 discs are right and only 1 chip right, right wins; if 4 to 7 discs are right and 2 or more chips right, wrong wins. If, however, all of the chips are right or all wrong, it is "no dice," regardless of how the discs are distributed.

After the cast has been revealed, the owners of the chips which turned up the same way as the cast can collect their bets. In other words, if wrong wins, all the players whose chips were lying uncarved-side up win from all those whose chips were turned the other way. In some cases one man collects from all of the others; in others all others collect from one man; this depends, of course, upon how many had wrong, how many right, chips.

The majority of board games, on all continents, are based on the same principle as the Seri dice game and Abia; that is, the determining factor is a flip of the coin, heads or tails, using any object which has two distinct sides, including cowrie shells and the knuckle-bones of sheep, deer, and other ungulates. Small stone representations of sheep's knuckle-bones, apparently symbolizing full-sized gaming pieces, have been found in collections of votive offerings, from Sabaean sites in Southern Arabia. The variable factor in these games is the system of scoring. In some cases, as in the two given as illustrations, it is often quite complicated.

A distinct step forward in the field of complexity is found in Parchesi and similar games, in which instead of a direct numerical scoring, the player indicates his gains or losses in terms of a symbolic progress, through the agency of markers, along some road on which he may capture villages, kill animals, and perform other deeds of adventure. A very widespread game of this type is *Mancala,* played in many parts of Africa, especially East Africa, usually with a pitted board, each hollow in which has some specific designation, usually that of a village or fort to be captured. The ancient Egyptians played this game, and in modern times it has been widely popularized by the Arabs, and also by Negro slaves, who took it to South America and the West Indies.

The Aztecs had a game called *Patolli,* played with five beans which had numbers painted on their sides as dice, which followed almost the same routine as the Indian *Parchesi.*[2] The Hindus were perhaps responsible

[2] Thompson, J. Eric, *Mexico Before Cortez,* New York, 1933, p. 237.

for the invention of six-sided dice, such as we use today, which were also much in vogue among the Greeks and Romans, and have also been used for centuries in Japan and China.

India and China seem to have been the centers for the world development of complex board games. Chess came from India, as far as can be determined, to Persia, where it arrived about the sixth century A.D., and was thence transmitted to Europe through the medium of the Arabs, as one of the contributions made to our civilization by the activities of the Crusaders. This is also the general history of playing cards. Either the Chinese or the Hindus invented them; they arrived in Europe during the fourteenth century. Draughts (checkers) were known to the Egyptians, later on to Greeks and Romans, and were extensively played by the Norse as early as the eleventh century.

Chess and cards, and to a lesser extent draughts, are games which involve complicated rules, and which form a radical departure from the simple coin-flipping techniques characteristic of most African board games, and most of those played by the American Indian.[3] They are also a considerable advance over the mancala-patolli-parchesi type, which merely makes a symbolic adventure out of scoring. Modern gaming in our Western civilization is dependent largely on the use of playing cards and such devices as the roulette wheel, while the six-sided dice of classical origin have replaced primitive coin-flipping almost entirely.

2. **Sports.** Athletic games, or sports, may be classified most easily according to the actual techniques employed. Simple sports which require no special apparatus and no large numbers of people, and hence can be indulged in by peoples at all stages of culture, are wrestling, boxing, foot-racing, jumping, and competitive swimming. Of this group of sports, wrestling is probably the most widespread and popular. Games which require simple apparatus include all sorts of ball games and dart-throwing contests. These also are very popular, and are almost universal in distribution. A third type of sports is that in which the actual physical effort which determines the outcome of the competition is not that of the human body, but of some animal, some mechanical device, or some natural force, controlled by human dexterity. Such sports are chariot racing, horse racing, sail-boat racing, and such modern forms as automobile and airplane racing.

Among the Ona of Tierra del Fuego, wrestling serves as one means of settling accounts after an injury which has given rise to a feud. The family

[3] Culin, Stewart, *Games of the North American Indians*, 24th Annual Report of the Bureau of American Ethnology, 1902-3, Washington, 1907, pp. 1-810. Culin's monumental work is the classic source on the games of the American Indians.

which has been attacked and which wishes to settle the affair without fighting sends an old woman, not worth capturing, to the hostile camp, to transmit orally the wrestling challenge. If this is accepted, the time and place are set, and the two parties meet as agreed. Each group of men forms a semi-circle, facing each other. With great formality, one of the older age group of the challengers stands in front of his contingent and makes a speech during which he states the reasons for their dissatisfaction, after which one of the younger men of his side, an expert wrestler, steps out in the old man's place and puts out a hand to draw a rival from the other side into the middle of the ring. They wrestle standing upright, and try to throw each other to the ground. As in most styles of wrestling, once a man has lost his feet and touched the ground with some other part of his body, he has been defeated. The challenger throws as many of the opposition as he is able; once he has been thrown, or is too exhausted to go on, another challenger takes his place, and this continues until either all of the opposition have been thrown, or all of the challengers. During the contest, the men standing in the lines praise the feats of their rivals. When the contest is over, they usually go home, and although they may berate each other at this time, as a rule they do not indulge in fighting.[4]

For our next example, we shall take a game in which simple equipment is necessary: a Polynesian dart match, as played in Tikopia.[5] The main principle of this game is to throw sticks with weighted ends along a prepared course, to see which contestant can throw his the farthest. This game is also very common in North America. A variant of it is the Chunkey game of the Southeastern American Indians, in which a disc is first rolled, and the winner is the thrower whose dart lands nearest the disc, exactly as in Italian bowling.

In the Tikopian game, a special course is used, consisting of a long narrow strip of ground, with weeds and other obstructions dug out, and the ground leveled and banked on either side. The course is about 130 yards long, and about 5 or 7 yards wide. The dimensions, however, are not standardized, and irregularities in the course are produced by local features of the ground. At each end of the course is a throwing base, like a tee, of soft sand, from which the players cast their darts. The dart itself is a cylindrical head of hard wood, to which is attached a light reed shaft. The players throw the darts by holding the tip of the index finger against

[4] Lothrop, S. K., *The Indians of Tierra del Fuego,* New York, 1928.

[5] Firth, Raymond, "A Dart Match in Tikopia," *Oceania,* Volume I, 1930-31, pp. 64-96.

the butt of the shaft; they wear rings of cocoanut fiber on the ends of their fingers to make this easier.

The island of Tikopia is divided into two sides, on the basis of the teams that oppose each other in the dart game, and membership in each of these sides is determined by birth. The teams, which consist of anywhere from twelve to twenty players each, are called the "Bachelors" and the "Married Men," although these designations have nothing to do with the marital status of the players.

The object of the game is for each team to get its darts ahead of those of its rivals. First one team throws all of its darts to the opposite end of the course; then the second team throws in the same direction. If a dart of Team B stops in such a position that any part of it overlaps in linear distance any part of an A dart, then the B dart is said to have "eaten" the A dart, and all A darts lying behind it. If a B dart "eats" the leading dart of A, no one scores. If a B dart passes all darts cleanly, that B dart counts as a score, and B will receive as many points as it has darts in this position. If A has several darts ahead of the farthest B dart, A can count all that are not "eaten."

The first side to win a round keeps on piling up its score as long as it continues to win consecutively. As soon, however, as it loses a round, its score drops to zero, and the other side scores. A game is ten consecutive points. If one team wins the first game, it need score only 9 points to win the second, 8 to win the third, 7 for the fourth, and so on to the tenth game, which it may win by scoring one point only. However, if it loses a game somewhere during this progression, the number of points needed to win the next game is 10, all over again. The match is ten games; if the teams win alternately, the full score is counted each time.

The third example which we will take is that of the sacred ball game of the Aztecs. This was played not only by the Aztecs themselves, but by most of the peoples of Mexico, including the Maya; similar games were played by the Indians of the southeastern United States, especially by the Creeks. In pre-Spanish Mexico, every town of any size had a ball court; some of the larger settlements had several. They were always built near temples, or had temples attached to them. The standard court seems to have been about 200 feet long by 30 feet wide, with cross alcoves at each end; the court was thus not rectangular, but shaped like a fat letter H. The walls were about 15 feet high, and faced with stone slabs. In the middle of each of the walls, in the main part of the court, was set a stone ring up near the top. This ring was usually so carved that it appeared to be

held by Xochipilli, the god of games.[6] Between the two rings was a line across the floor, dividing the court into two halves, one of which was the territory of each side.

The players were divided into teams which opposed each other in hitting a rubber ball on hips and knees; it was against the rules to touch it with the hands or feet. It is said that some players could keep it in the air an hour by this method. The scoring depended on two occurrences: the main object of the game was to carry the ball into the enemy's end of the court; if one team actually placed the ball in one of the side alcoves on the rival end, it won a point. We are not told how many points were needed for a game. The second object of the game was to put the ball through one of the rings in the middle; one ring belonged to each team, and the ball must go through the right ring, apparently. This ring-scoring did not happen every game; in fact, it was a rare occurrence. When it happened, the player who made the shot was entitled to take all of the clothing and other belongings of the spectators who sat on top of the walls. Thus when a ball went through the ring, the spectators ran, with friends and teammates of the man who made the score in pursuit.

The ball games of the North American Indians were based on the same principles as our hockey, shinny, and football, in that the scoring was dependent on getting the ball between the rival goalposts at the far end of the field, or on touching these posts. The Creeks and Choctaws used webbed lacrosse racquets in their usual form of the game.[7]

III. THE LOGIC OF COMPETITION

The process of development of the different types of games just described has necessarily been accompanied by the formulation not only of the rules by which the game, or games, are to be played, but also of the way in which the players must compete.

The board games of most primitive peoples consist of the flipping of markers with two distinct sides; the rules needed to regulate such games are of a simple nature. The Parchesi type of game requires more elaborate rules, and such games are found only among relatively advanced peoples. Chess and draughts are limited to such peoples as the Chinese, the Hindus, the Moslems of North Africa, and the Norse of the late pagan period; these games require exact standards of movement of a rather complex nature. The rules which govern most modern card games are so complex

[6] Thompson, J. E., *op. cit.*, pp. 233-236.

[7] Haas, Mary P., "Creek Intertown Relations," *American Anthropologist*, N.S., Vol. 42, 1940, pp. 479-489; see also Culin, *op. cit.*, pp. 597-608.

and so exact that much practice is needed to learn them, and professionals are able to develop such skill that they can defeat almost any amateur. With a simple game like coin flipping, anyone who is honest can play with equal chances of winning.

Rules in athletic games are likewise subject to differences in degrees of standardization. We are told that one reason why so much time elapsed between ball games in the Creek confederacy was that before each match, after the challenge had been accepted, the towns sent officials to hold a conference, and to agree on the following: the date of the game, the place at which it should be held, the distance between the goals, the distance between goalposts at each goal, the number of men who should play on each side, and the identities of the players. All of these points, except the date and the place, are automatically standardized in our contests.

Even in ancient Greece, however, the Creek system of arranging each set of rules in advance was followed. The judges met at Olympia ten months before the contest, to decide on all the rules, the order of events, and on related matters. In Olympia, the length of the race course was not determined by any system of measurement, but it was simply once around the stadium. The elaborate rules which govern all of our games are partly products of the Middle Ages, but mostly of modern technological developments. We specify, for example, the exact dimensions of a ping-pong table, and the exact weight of the ball used in this game. Baseballs and golf balls are not permitted in tournaments or professional games if they are of the wrong size or weight. Rules governing play are so elaborate that we have books which establish and codify them, such as the works of the Marquis of Queensberry and of Hoyle. In most important contests, professional judges, or umpires, are needed, to see that the rules are kept by both sides. Probably ninety percent of the people who watch a college football game do not know all of the rules; some of the players may not know all of them either.

Within the framework of the interaction afforded by special types of games, characteristic patterns of interaction are developed for each people. If measurements are made of the timing of the interaction of different games, the student will begin to understand not only why certain games are congenial to certain people, but also why they play such an important part in developing conditioned habits of interaction in the young which are carried over, through continual use, to adult life.

Within both board games and athletic games, there are marked differences both in the amount of interaction in each event, the opportunity for set events, and the kind of synchronization possible. A game like the African Abia involves rapid group interaction with differential opportunities for

each player. The Seri type is limited to an alternation between individuals or sides acting as one. Similarly, in athletic games there are varieties involving paired interaction, like boxing or wrestling, each of which is markedly different in its quantitative pattern. Another example is lacrosse, which differs in this sense from football. Where complex teamwork is required, each team becomes an institution, and as a result, in the symbolic description of competition, we find the emphasis on sportsmanship, teamwork and leadership, which is so prominent in this country, and which the English sum up in the remark allegedly made by the Duke of Wellington, "The battles of the British Empire are won or lost on the playing fields of Eton." As we shall see in the case of warfare, the same attitudes are carried over to the field of battle.

IV. GAMES AND INSTITUTIONS

As the preceding descriptions of games have made evident, games have much to do with the development and procedure of institutional activities. A single contest, as we shall show, may be concerned with many institutions at once; hence it will be easier to to treat a few specific games as examples than to discuss the subject by institutions. The examples will be those described from a technical standpoint in the preceding section.

In reference to our first example, that of the Seri gambling game, we have not enough information to make such an analysis possible. With the Abia game of the Pangwe, however, our evidence is clear. Among the Pangwe, there are no hereditary classes: position depends largely on wealth, and mobility is often rapid. There are three classes; chiefs, commoners, and slaves. Either a chief or a commoner may become a slave, while a commoner can become a chief. One of the principal uses of wealth among the Pangwe is the purchase of wives; another the building of a men's house.

A chief is a man who has purchased many wives, sometimes as many as a hundred, and who has built a men's house. His establishment is, in effect, a village. He reserves, as a rule, from three to five wives for his own use, and exchanges the privileges of the marital relationship with the others with men who cannot afford the high price of purchasing a wife. These pay back their debt to the chief in services. Not all of the extra wives are thus loaned out, however; a chief may loan some to men who pay for their use in spearhead currency, the amount of the payment depending on the length of time involved. The loaning of wives for services is thus an arrangement which ideally has some permanency; the loaning for cash payment, one which is placed on a definite time basis. In this way, he builds up a follow

ing; the more wives he can buy, the larger the group to whom he can originate in set events.

The chiefs sit about their men's houses every afternoon with their followers, after the latter have finished work, and with any guests who have come on reciprocal trading expeditions, or who merely happen to be present. This group plays Abia, the principal betting taking place between the chief and his guests of equal financial solvency. The wagers are often high; sometimes a man who has lost everything else will stake his freedom on the outcome of a flip of the basket. A loser who has been borrowing credit from another player and cannot pay up will be sold as a slave unless his family ransoms him at once. After the game, the chief orders the debtor put in the stocks; and if he is not ransomed in the meanwhile, he is sold at noon the next day.

From Siegel's account of the results of Pangwe gambling, this type of board game is the fundamental technique controlling the system of relations among these people. By furnishing the means for obtaining wives, it regulates the size of the family. Since possession of a wife may be lost by a cast of the chips, it also makes the relationship unstable. It regulates the distribution of wealth, and thus controls the stability of economic institutions; politically, it determines who shall rise to the chieftainship. As a ritual technique, the dice act as oracles to express the will of the gods, since the Pangwe, like most other peoples, do not understand the laws of probability, and see in success or failure the result of magical activity. As in the case of the sasswood trial and other ordeals, loss is considered an expression of the wish of the supernatural. The gods, not men, are blamed. Naturally enough the players vie with each other to influence their own chips by means of private ritual.

The next example to be considered is Ona wrestling. Here the institutional value of the sport is easily apparent. Among the Ona, there is only one institution, the family horde, or band, with its own hunting territory. One band may offend another by trespass, by murder or personal injury, or by stealing women. Often the aggrieved band fights, and thus begins a feud, which may go on indefinitely, with disastrous consequences to both sides. The wrestling match, in the first place, greatly strengthens the interaction within each band, while it acts as a means of working off the tension between the contesting groups without bloodshed; if successful, it ends the feud. It has the same function here as a peace-making ritual.

The dart match in Tikopia provides an excellent opportunity to study the place of an important game in a community which is complex enough in structure to permit the emergence of separate institutions. In the first

place, the two sides which take part in the contest represent moieties, chosen on the basis of residence, but inherited by clan affiliation, although a few clans are split by this division. The two districts which rival each other are the Faea and Ravaenga.

Before the game there is much ritual, to influence the gods of the clans and districts to give victory. The chiefs and elders rub the heads of the darts with oil, while praying for victory, and they offer gifts of tapa and food to the gods in return. On each side there is one specially holy dart, which is brought out only for very special matches. On the morning of the match the darts are oiled again, and the player's arms are ritually oiled, to make him throw well.

At the beginning of the game, the four chiefs of the island sit at one end of the pitch; one chief, who belongs to one of the moieties, on one side; the other three, who belong to the rival moiety, on the other. The first man to cast throws his dart carefully, so that it will go straight, rather than to try for distance. If his goes straight, the others of his team should also, even if they are thrown as hard as possible. Meanwhile the four chiefs close their eyes and pray to their gods for victory. When the first round is over, they open them to see who won. The chief whose side has lost may reprove the god for letting him and his people down. Other spectators cry out all through the game to their own gods to block the darts of their opponents. The play starts early in the morning and it is then thought that the gods are present and actively interested, and hence very influential; later on, as the game proceeds, the gods lose interest and go away. The keen initial interest of the players and spectators is thus symbolized.

From the standpoint of organization, each side has a dart chief, or captain, who is chosen by the chiefs and prominent men of his moiety. He keeps this office until he is too old to play any longer.

The match itself is played infrequently, and much preparation takes place each time, since the pitch must be cleaned and smoothed before each game. It is believed that the match, whoever wins, will bring fertility to the island, and especially to the breadfruit trees—that it will ensure the prosperity of the people as a whole; it is thus part of an increase ceremony, in which the people symbolically heighten their interaction with the environment which feeds them and actually heighten it with each other.

Oddly enough, despite the amount of knowledge current about the Aztecs, we cannot be sure of the exact institutional position of the sacred ball game. We know that it was the occasion of much betting; we also know that it was played in connection with religious worship, since the court was always connected with a temple. On the political side, it served,

like Ona wrestling, to prevent fighting; tribal chiefs sometimes arranged games to settle outstanding quarrels.

The ball games of the Muskhogean Indians, which were held in connection with annual tribal ceremonies, were strongly ritual in character, but their primary institutional function was the regulation of moiety affiliation,[8] at least among the Creeks. The towns of the Creek confederacy were divided into two "fires" or moieties, called reciprocally "my friend" and "my opponent." In English they call the sides Red, or War, and White, or Peace. The towns on the same side were friendly; those on the other side hostile, or at least distrustful. This opposition came to a climax in the lacrosse game, described earlier. Once a year a town of one moiety would challenge a rival of the other moiety. Each town had some particular rival on the other side, but would play anyone who challenged. It was considered correct for the team which had lost in the last match with a given rival to challenge that rival the next time they played. In case two towns had never played before, either one of them was free to challenge the other.

The games were held in the summer, soon after the Green Corn Ceremony, which marked the first harvest. As a rule each town played only one game a year, since the ceremony which preceded the game took a long time and much effort.

If one town lost to another four consecutive times, and it made no difference how many years apart these contests were, the losing town would be taken over into the moiety of the victor; its members would become their "friends," and their old friends would now be opponents. In the history of the Creek confederation, towns have shifted their moiety affiliation a number of times. This system of sport, therefore, is of prime importance in the political organization of the Creek nation.

As Miss Haas points out, the symbolism of the game is that of war, since the terms used to describe the negotiations and plays are taken from the context of war. Furthermore, the adoption of a defeated village by its conquerors is exactly what happened when the Creeks won a military victory; there was much adoption of prisoners, as well as ritual torture and killing of some of them. It is quite possible that the Creek system of ball games may have supplanted internecine warfare at the time of the formation of the confederacy, although this is a purely speculative historical deduction.

The importance of games in the development of institutions and in maintaining them in a state of equilibrium can scarcely be over-emphasized. The Olympic games, for example, were an important part of the political

[8] Haas, Mary P., "Creek Intertown Relations," *American Anthropologist,* N.S., Vol. 42, 1940, pp. 479-489.

system of the Greek States, maintaining them in relatively stable relations with others. Like the Kula system, they brought about extensive commercial relations between the members of the different states.

Most of our institutions have teams to represent them in games; schools, colleges, churches, factories, stores, and associations have football, baseball, and basketball teams. Bowling leagues and soft-ball leagues blanket the country, and dozens of so-called minor sports, from bridge and chess to tennis and golf, provide interaction between the members of systems.

With any type of activity which plays such an important part in institutions, institutions arise which are specially concerned with this kind of competition. The development of professional athletes, the manufacture of technical articles for use in these games, the development and care of ball fields, golf courses, tennis courts, etc., are important institutional elements in our civilization. *Mumis* arise within these sports who have followings just as artists do in another sphere. The symbolic configuration developed out of competition in fact goes one step further. It includes within it a lethal form of competition, which, as we have seen in Chapter 14, is the chief element in the development of the state.

V. WARFARE

In the games which we have just studied, one might make a steady progression from board games like checkers or parchesi through those that require a little exercise, such as table tennis, to those that require a great deal, like boxing and wrestling. If this principle is carried further, another element comes in: the amount of danger in the game, ranging from none in board games to a considerable amount, as in lacrosse, where the players are continually hitting each other over the head, and American football, in which a doctor may be called on the field a dozen or more times in a single game to treat anything from a sprained thumb to a broken neck.

But these games mentioned above are not supposed to cause injuries, although they sometimes do—even fatal ones. There are other games, however, in which the death of one or more participants is expected, and the heightened interaction is followed by a disturbance of equilibrium. In this way, the symbolic configuration of games may be applied to the activities of war, and we find the development of duels, chivalry, and international rules of warfare. Very often people have two sets of rules which they use in warfare: one against "noble" or "civilized" enemies, the other against complete outsiders.

For example, if the Jibaro Indians are fighting members of related clans, the warriors will not decapitate their slain adversaries, but if they

feel that there is no tie of kinship between themselves and the deceased, off comes the head. The Bedouin, as we have seen, distinguish between tribes which they call "cousins" (Beni el 'am) and those which they do not, and treat them accordingly. They will not attack a camp of "cousins" before daybreak, and when they capture a "cousin" they will not kill him or tie him up, but simply tag him with a piece of cloth and leave him sitting on the sidelines on parole not to rejoin his own side until he is ransomed. They do not show this deference to outsiders. Europeans in modern warfare used, until recently, to make formal declarations of war on each other, hold formal parleys between the lines under a flag of truce, and accepted a long list of conventions including rules for the treatment of prisoners, rules prohibiting the injury of civilians, and the prohibition of dum-dum bullets, which tear an unsightly hole in the person hit.

However, they were seldom concerned about formalized rules when fighting non-Europeans; in South Africa, white colonists have been known to go out on shooting expeditions to exterminate the Bushmen without declaring war or taking prisoners or sparing women and children, and to leave poisoned meat lying around for them to eat; other such hunts have been known in Australia, and in Tasmania the settlers fought a war of deliberate extermination against the blacks. In Tierra del Fuego, it used to be a common practice for sheep ranchers to go out shooting Onas in general after some of them had killed their sheep. In all of these wars against bothersome primitives, no holds were barred.

The point of this is that in the political institution, the external relations set is made up both of the members of the group who are origins, and the other group who are termini, and when the rate of interaction reaches a certain height, war results. Now we saw that in economic institutions, where a comparable set is found, in many cases the trader-customer relation becomes formalized through a high frequency of interaction, in which the customers become a constant part of the personnel of the system, a more or less stable terminator group. The same thing can happen in warfare; two tangent political institutions between which a conflict habitually or regularly arises may stabilize their relations through warfare. This is not a war of extermination, such as they might fight with outsiders if occasion arose, but a formalized kind of war in which the enemy becomes a more or less constant part of the personnel of the system, and in which the interaction, through the use of rules to which both sides agree in advance, is habitually ordered, exactly as through the symbolic configuration of games. This is especially borne out in cases where war takes on a cyclical character, where

it may become in effect a Rite of Intensification. Indeed, as we have seen, many Rites of Intensification include games as part of their ritual.

This can be well brought out by a few examples. Wedgewood[9] states that in northern New Caledonia, the villages are divided up into two divisions, much like the Red and White moieties of the Creek, or the two sides involved in the dart game in Tikopia. These two sides have a formal battlefield, on which they always fight, and they meet there in battle once every five years. When the time for the battle approaches, the leaders of the two sides send heralds, whose persons are inviolable, to make arrangements. By this means a day is set, and the warriors of the two sides meet at the battlefields, where they first work together clearing the undergrowth which has grown up since the last combat. When the field is ready, they line up facing each other, and start off with oratorical contests, followed by single combats between chiefs, in which as a rule no blood is shed. Then the armies start hurling spears or shooting arrows at each other, and after this, close in and fight hand to hand combats with clubs.

When the first victim has been killed, they stop for the day to hold a funeral, and begin again the next day, until enough people have been killed or until the point has been reached beyond which the combat would become too serious for the maintenance of equilibrium, when they grow tired of it and agree to stop. After this, they have a formal peace-making ceremony in which they pay each other in pigs or some other commodity for each man killed, and have a feast together.

Among the Plains Indians, warfare was also cyclical, but it came every year instead of once in five. As we have seen in earlier chapters, summer was the war season, and when the time approached, the warriors began to make preparations. When they were ready, they would go out seeking the enemy, and in battle certain men would perform specific deeds and follow specific rules. Thus there were the "Crazy Dogs" who drove stakes in the ground and tied themselves to it by thongs. A Crazy Dog would fight anyone who came within the radius of his leash, and would not pull his stake until the battle was over. A regular practice of Plains warfare was the custom of "counting coup," that is, rushing in and touching an enemy, or touching his horse, etc.; like a game in which the scoring is done by tagging opponents. Plains warfare not only regulated the interaction between tribes, but it also served as a framework for organization within the tribe; it furnished a formalized set of achievements by means of which a person

[9] Wedgewood, Camilla, "Some Aspects of Warfare in Melanesia," *Oceania,* Vol. I, 1930, pp. 5-33.

attained his position in the political hierarchy and by which social interaction in general was regulated.

Many peoples in the world, owing to their technological adjustments to their environments, spend whole seasons with nothing or very little to do, as far as getting a living is concerned. On the Northwest Coast, the Indians did most of their fishing at the time of the salmon runs. During the winter they spent most of their time performing rituals in their associations. In many parts of Melanesia, the Social Climbing Feasts furnish a means of ordering interaction for people whose technological activities do not provide enough for their needs. Warfare, particularly when it occurs on a seasonal basis, also fills this role.[10] This is the chief reason behind the head-hunting activities of many peoples living by slash-and-burn agriculture without domestic animals throughout the tropical forest regions of the world, where the women produce most of the food. It will also serve to explain the development of ritualized warfare on the Plains, where most of the year's food was secured in the space of a short time.

So far, we have considered the ritual aspects of war between groups only. However, the symbolic configuration of games is also found in single combats and duels in many parts of the world. In the United States, it has long been a custom for men (and even more frequently for adolescents) who come into conflict to fight each other with their fists. The form of combat follows definite rules. One cannot hit below the belt, kick, bite, gouge eyes, etc. When one of the combatants has fallen down, the other is required to wait until his adversary has regained his feet before striking him again. If a crowd of spectators assembles, as is often the case, the crowd itself will often see that these rules are enforced, and suitably punish any breach.

European history is particularly rich in variations of the duel. In Sweden it was once the custom, and this was not so long ago, for two men who wished to have it out to strap themselves together by a leather thong attached to their belts, so that they could not draw any more than two feet apart. Then, at a signal from a third person, each slashed out with a knife. In early Ireland, a shield was kept hanging from the gatepost outside many of the fortified camps and clan strongholds, and any passerby who wished to challenge the inhabitants of the place could strike the shield with his sword, ringing it, and the local champion would then appear. From this custom arose our word "swashbuckler." In fights with lethal weapons, such as knives or swords, both combatants start originating to the

[10] There is considerable evidence that the Social Climbing Feasts increased in frequency and importance both in Melanesia and the Northwest Coast after the whites suppressed organized warfare. Oliver, D. L., personal communication.

other at once. In others, where fists or sticks are used, very often the order of action is prescribed, and the combatants take turns hitting each other, as in the old English quarter-staff tradition.

In order to see what were the conditions that warranted the formal duel in many European countries, let us take the *holmgang,* the classic duel of the pre-Christian Norway and Iceland. The challengers were usually Berserks, to whom we have already referred (Chapter 14). Berserks "seem to have no land and no families, except that sometimes two Berserks are brothers. They wander about in groups or singly with a band of followers. They demand women or property from those they encounter. They are described as being big and strong and easily angered almost to a state of frenzy. Often they took service under Scandinavian kings or nobles who kept bodyguards of fighting men. The only explanation that I can arrive at is that they were men of rank who had lost their land, or younger sons who, having no land, wandered about taking what they could get. In many cases they were little better than robbers. Finally Berserks were outlawed." [11]

> It was no uncommon thing throughout Norway that robbers and other ruffians came down from the forest and challenged men to fight for their women, or carried off their property with violence if there was not sufficient force in the house to protect it. One day at Yule-tide there came a whole party of these miscreants to Einar's house. Their leader was a great Berserk named Snaekoll. He challenged Einar to hand over his daughter to him or else to defend her, if he felt himself man enough to do so. Now the bondi [householder] was no longer young, and no fighter. He felt that he was in a great difficulty, and asked Grettir privately what help he would give him, seeing that he was held to be so famous a man. Grettir advised him to consent only to what was not dishonorable. The Berserk was sitting on his horse, wearing his helmet, the chinpiece of which was not fastened. He held before him a shield bound with iron, and looked terribly threatening. He said to the bondi:
>
> "You had better choose quickly; Whether one thing or the other. What does that big fellow standing beside you say? Would he not like to play with me himself?" [12]

This quotation is from *The Saga of Grettir the Strong,* composed after the holmgang had been abolished. The saga also states how changing conditions in Norway made the holmgang no longer a suitable means of adjustment.

[11] Harding, Charles F., III, *The Social Anthropology of Early Iceland,* Senior Honors Thesis in Anthropology, Harvard University, 1938 (unpublished), pp. 13-14.

[12] Hight, G. A. (translator), *The Saga of Grettir the Strong,* Everyman's Library, pp. 110-111, p. 46 (after Harding).

It was considered a great scandal in the land that pirates and berserks should be able to come into the country and challenge respectable people to the holmgang for their money or their women, no weregild being paid whichever fell. Many had lost their money and been put to shame in this way; some indeed had lost their lives. For this reason jarl Eirik abolished all holmgang in Norway and declared all robbers and berserks who disturbed the peace outlaws.

The holmgang provided the legal means for the berserks to make their demands. The holmgang was a very formalized duel which was legal until about 1006. There were many laws concerning it. A man who had thought himself wronged or who wished another man's property was the challenger. They met with followers on the island [holm] on the proper day, and the laws of the holmgang were read.[13]

The law of Holm-gang, or Wager of Battle. It was the law of wager of battle that there should be a cloak of five ells in the skirt and loops at the corners. They must put down pegs with heads on one end that were called Tiosnos. He that was performing must go to the Tiosnos so that the sky could be seen between his legs, holding the lobes of his ears, with this form of words [form lost], and afterwards was performed the sacrifice that is called *Tiosno-sacrifice.* [A bull was killed.]

1. There must be three lines about the cloak of a foot breadth; outside the lines there must be four posts, and they are called *hazels,* and the field is *hazelled* when this is done.

2. A man shall have three shields, and when they are gone, then he shall step on the skin though he have left it before, and then he must defend himself with any weapon henceforth.

3. He shall strike first that is challenged.

4. If one of them be wounded so that blood come on the cloak, they shall not fight any longer.

5. If a man step with one foot outside the hazels, he is said to flinch . . . ; but if he step outside with feet, he is said to run.

6. His own man shall hold the shield for each of them that fight.

7. He shall pay holm-ransom that is the more wounded; three marks of silver as holm-ransom.[14]

Thus the challenger and the challenged went with followers to an island off the shore; they set up a ring and laid down a hide on which they were supposed to stand while fighting. Each man had three shields, and one of his companions held these shields in front of him, one at a time, until all three had been rendered useless, and then the combatants fought without shields if the fight was not over. It is interesting to note that the

[13] Harding, *op. cit.,* p. 17.

[14] From the Cormac Saga, translated by Vigfusson & Powell, *Origines Islandicae* Oxford, 1905 (after Harding).

fight was conducted with a strict order of action, with each striking in turn, and the person challenged having the advantage of the first blow. Owing to the rule about stopping the fight at the first blood on the hide, these fights were not always deadly.

Fights of this kind furnish a means of adjustment when there is no central political institution, or when it is not strongly developed. In the Middle Ages they were taken over into the practices of chivalry, where knights could challenge each other over the affections of a woman, or over property, and fight it out with different weapons and different but equally formalized rules. These personal combats, in heathen Norway as well as in the days of chivalry in Western Europe, were limited to persons who were equals; a knight did not challenge a peasant any more than a Berserk would challenge a thrall. This is a part of the principle already observed, that the configuration of games is taken over into warfare only in cases where the groups fighting each other have a relatively high rate of interaction to begin with, since they occupy comparable positions in the same system or in tangent systems, and fall within the same groups delimited by "fissure lines" as explained in Chapter 17. A Norwegian nobleman would kill a thrall if a combat situation arose, without rules or formality, or he might ask one of his dependents to do it for him, and so would the knight, just as a European would poison a Bushman, or have his hired help shoot him.

SUMMARY

Games constitute a category of play, distinguished by the fact that they take the form of competition between individuals or groups of individuals. They are conducted according to formal sequences of prescribed interaction in which, within the limits of a specific technique, individuals originate to one another alternately, or one side tries to exceed the other in originating simultaneously. They therefore provide at all times a technique for increased interaction and serve as an outlet for this increase when needed.

Very frequently games make up the element of transition in a ritual, and thus provide an effective and intense means of building up ordered interaction, or games may begin with ritual when they involve a change in interaction rates, as in the use of organized cheering and marching bands of music at college football games. Games may thus be regarded in many cases as a means of maintaining equilibrium in sub-systems or tangent systems, across "fissure lines," which is a service also performed by associations, some of which are formed about the context of games.

Another difference between games and ritual is that ritual symbols and

techniques are always taken from the context of situation which makes up the habitual interaction of the individuals involved; games, however, only occasionally use such symbols and techniques, and when they do it is merely to provide a context for the play. Games differ greatly in the number of people taking part and in the complexity of rules. Also some games build up interaction between the players alone, while others do the same for vast audiences.

A game canalizes potential conflict between opposing institutions by bringing about interaction at a high frequency but within the rhythmic order imposed by the techniques. Games thus prevent conflicts; they provide regular opportunities for interaction within habitual techniques by using well-known symbols, and this provides a constant framework for interaction. In this way games provide one of the most important means of preserving equilibrium in a society such as ours where there are constant changes in interaction rates due to changes in technology and institutions.

When the interaction rate in a game reaches a certain pitch of intensity the game becomes lethal, and when deaths come to be expected we are dealing with formalized warfare, which is merely an extension of the games configuration. Familiar examples are formal duels and the rules of chivalry. The point is that in the political institution the external relations set is made up of both the members of the group, who are originators, and the members of the outside group, who are termini. When conflict situations repeatedly arise between two groups, their internal relations can be stabilized through a formalized kind of warfare in which the enemy becomes a more or less constant part of the personnel of the system.

The rules differ markedly between games and between types of formal warfare. The games and types of warfare, if any, are usually fitted to the needs of the society in question for the maintenance of equilibrium. In the simpler societies it takes a considerable amount of discussion before each important contest to determine the dimensions of the field, the number of players, and the rules of play. In more complex societies these rules, like laws, become codified. In some societies games may form the framework for other institutions; among the Creek moiety affiliation depended on success or failure in games. In our own society games furnish a symbolic framework for conditioned routines of behavior which we apply to our actions in other institutions, and hence we derive our ideas of "fair-play" and "playing the game," which help us to maintain equilibrium.

CHAPTER 27

Money: Symbols and Techniques of Exchange

I. INTRODUCTION

Trade or exchange are terms applied to events between individuals in which one person originates to the other by giving him some object or performing a technique; and in return, the second individual originates by giving the first a different object or by performing a different technique. Primarily then, exchange involves interaction in which the origin of action of one person is balanced by an origin of action by the other. This reciprocal aspect of the relationship maintains the interaction of the individuals in a state of adjustment and thus serves to stabilize the equilibrium of the individuals concerned and of the groups to which they belong.

At various places in this book, we have discussed in some detail instances of trade or exchange. In Part II, we saw how the division of labor was primarily dependent upon trade, and in Part III, Chapter 15, we outlined the development of economic institutions, which were based upon the rise of a commercial set between a trader and his customers. In discussing economic institutions, however, it was clear that events involving exchange occurred not only in the commercial set, but also throughout the other sets in the economic institutions, and they also took place with a moderately high frequency in other institutions. Thus one of the simplest forms of economic institution, in Taghzuth, was dependent upon a tangent institution, the family, for the manufacture of the objects which were exchanged in the trader-customer set. Similar events occur continually in the interrelations of institutions as well as within the institutions themselves. The constant exchange of goods and services is, therefore, not limited to economic institutions; it is dependent upon the use of objects and services in the technology, which, as we have emphasized, is found throughout all systems of human relations.

Through this process, a complex configuration of symbols and techniques has developed, comparable to the configurations of ritual, language, art, and competition. Like the others, this configuration varies consistently from place, in concert with other variations in environment, technology, and in-

stitutions. In our study of exchange, we shall first analyze the techniques which have been developed in different places, then see what logical categories have been developed out of exchange, and finally see, in brief, the way in which exchange systems depend upon institutions.

II. UNITS OF EXCHANGE

Let us consider for a moment the differential values of the goods or services exchanged by A and B. They do not give each other identical objects or services, except in the ritual contexts of situation—but rather A provides some commodity which he has in abundance, in return for some other which B has in abundance.

There are, however, degrees of abundance. Some objects take a long time to make, and the raw materials of which they are fashioned may be difficult to obtain. Such objects will naturally command higher values than those which can be produced or made quickly from abundant and readily available materials. If A is dealing in rare objects and B in common ones, the quantity of A's contribution will be less than that of B's. The same is true of services. The working time of a skilled technician is more valuable than that of a common laborer.

If A and B once enter into an exchange relationship, they are likely to maintain it. As long as no event occurs to disturb this relationship or upset the balance which they have reached, they will continue to give each other the same values as in the beginning. In order to make sure that each is carrying out his side of the bargain, it is useful for them to have some units of exchange, some scale of values, by which they can measure their separate contributions and compare them. The simplest and most basic procedure is to establish these units in terms of some of the consumable objects with which the exchange is made.

For purposes of units of value, all classes of objects are not equally suited. There are five principal criteria by which the relative symbolic utility of exchange commodities may be determined.

1. Their Natural Uniformity. Cocoanuts when ripe are roughly the same size; one is as good as another. Pigs, on the other hand, vary greatly in size, fatness, and age. Furthermore, female pigs are more valuable for breeding than male pigs.

2. Their Universal Utility. Objects which everyone can use and which are important in the relationships of all persons who might be involved, make excellent units of value, if they meet the other requirements. Such objects or commodities include salt, bricks of tea, again cocoanuts, cacao beans, kola nuts, hoes.

3. Their Usefulness in Ritual—often through some inherent esthetic quality. These include shells, boar tusks, fine textiles, and ornaments of metal.

4. Their Imperishability. Taro roots rot after a year of storage, and so do other tubers, roots, and fruits. Animals may contract illness and die, but shell and metal are relatively indestructible.

5. Their Portability. Small, easily packed objects which are not likely to spoil are the most useful. In the case of livestock, the unit of value provides its own transportation, except for pigs, which are difficult to lead or drive.

Let us take a commodity, for example, which meets four out of the five conditions: bars of salt. In the central Sudan, where meat is scarce and the heat intense, and where the Negro population, abundantly provided with sweat glands, perspires freely, there is a great physiological need for salt, and everyone wishes to possess it. In exchange for salt, a local farmer will exchange any object that he can persuade the salt-trader to take. A man who intends to travel through this country does not need to take bulky packages of food on his journey; instead he has only to load a few animals with uniform, imperishable, relatively compact bars of salt. If he buys a goat, a basket of grain, or a new spear, he will pay in units of salt.

Systems of exchange such as that exemplified above are not, as a rule, operated on the basis of one commodity alone. In the same region that bars of salt are used, cattle will furnish a second group of units, sheep possibly a third. It is only with the use of true money—intrinsically useless symbols—that a single configuration of units, in which some symbols will be designated as multiples of others, develops.[1]

The Emergence of Forms of Currency. In tracing the development of the concept of money, the simplest procedure will be to work through various cultural stages from simple to complex. There are three main stages; as far as money is concerned: (1) no units at all; (2) multiple units; (3) a single unit system. In discussing these stages we refer to the use of units of exchange within groups of people who habitually interact; the subject of foreign exchange, in the modern sense, will be treated later.

1. The Absence of Units. In societies of simple food-gatherers who do not preserve food and hence have no surpluses of vital necessities, the exchange relationships between groups are carried on on a basis of individual

[1] Of course, no type of money is wholly useless as intrinsic material. You can plug a fuse socket with a penny, melt down silver dollars to make spoons, fill teeth with gold, and light cigars with five dollar bills. These uses, however, are either unprofitable, or illegal, or both.

exchange. Among the Andamanese, two villages will meet at stated intervals, once or twice a year; the members of one village will give the members of the other some commodity that the latter need, such as lumps of red ocher, while the other may furnish vegetable fibers used in binding weapons. Neither asks the other how much of its commodity the interacting partner wishes; there is no attempt to set an exact scale of values.

Among the Australians, there is a wide trade in stone axes, which are made in the north, spears, which are made in the south, and shields, which are made in Queensland. These objects pass from tribe to tribe, and while near the source of spear-wood, six spears are worth one stone ax; farther away six axes may be worth one spear. The value shifts in relation to the source of supply of each commodity being exchanged. There is, however, no fixed unit of exchange. All spears are not alike, nor all stone axes; the persons making the exchange make sure that the objects which they receive are in good condition and well made.

Food-gatherers who live in tropical forests all, as far as we know, with the exception of the Andamanese, have trade relations with peoples outside, and hence fit into larger systems. The Vedda, who will serve as an example, trade pots of honey and flitches of preserved venison for iron-tipped arrows and lengths of cloth. The pots, flitches, arrows, and lengths of cloth are of more or less standard size and shape, although this is not strictly regulated.

Food-gatherers in northern forests, on the other hand, have a convenient article of trade in furs. The beaver skin, of prime quality, has long been a standard unit of trade in Canada, and was once used in this way in the Mississippi valley. It was, however, subject to inspection by the fur traders, and its value depended on its condition.

2. *Multiple Standards: Shell Money*. Many peoples, both food-gatherers and agriculturalists, who preserve and store food, or who have a constant abundance, use shells, either in their natural form or altered in some way, as money. In California, there were several kinds of shell money: dentalium shells, imported from the Northwest Coast, and clamshell discs from San Francisco Bay and from the Chumash country in the region of Santa Barbara. The discs were perforated and strung; their value depended on their size, age and polish. These strings of money were measured on the hand and forearm; one measure was the circumference of the first, another the distance from fingertip to elbow. The value of the clamshell variety varied according to the distance from the sea. The region in which the dentalium shells were used overlapped that of the clamshell money.

In New England, the famous wampum of colonial days was made of quohaug shells, with two kinds, white and purple, considered of different

values. The purple was worth more than the white. This wampum was originally made on Long Island for local use only; the colonists were responsible for its extension over New England and New York State as a medium of exchange.

The world's greatest area of shell money lies in the Pacific, and includes most of Melanesia and Micronesia. Three examples from this area will serve to illustrate its use; these are (1) the Buin district of Bougainville in the Solomon Islands, next to the Siwai tribal area studied by Dr. Oliver; (2) the Micronesian Island of Yap in the Carolines; (3) the Trobriand Islands, the seat of the *Kula* exchange system.

In Buin,[2] there are four kinds of shell money: *abutu,* or ordinary shell money, is made of shell discs strung on fiber cords. It comes in bundles ten fathoms each in length, with a marker at the end of the sixth fathom, and a snail shell at the end of the string, to mark the number 10. This marking is done because they count as follows: 1, 2, 3, 4, 5, 6, 10 minus 3, 10 minus 2, 10 minus 1, 10. There are no words for 7, 8, and 9. Six marks the limit of their separate numerical system. The fathoms, as elsewhere in Melanesia, are arbitrarily measured; needless to say, they are not of uniform length.

Ten cords of ten fathoms each, or one hundred fathoms all together, are packed in a net bag, as a standard unit of the second magnitude, and these bags are placed in the sleeping houses for the ancestral ghosts to perch on. Thus money serves as a spirit-placing as well as a medium of exchange. The *abutu* is not made in the Buin district proper, but on a small island off the coast, where the inhabitants have a monopoly of its production.

Besides *abutu,* there is a variety called "women's money," twice as valuable, and two other kinds, made from red and white varieties of a shell called *onu.* The white is worth ten times its length of *abutu,* the red twenty times. All these kinds of money are used in buying pigs and other food; the values of pigs are always given in round numbers, 10, 20, 100, and so on. The money is also used to maintain position in institutions, since the host at a banquet boasts of how much he paid for each pig, and some of it is cremated with the dead at funerals.

In Yap,[3] in the Carolines, the monetary system is more elaborate. There are actually six kinds of money, of which only three are made of shell. Of the other two, one is cocoanuts, the standard unit of exchange in relationships between the natives and white traders; a second is the famous *fei,* or stone money, for which Yap is renowned everywhere.

[2] Thurnwald, R. C., "Pigs and Currency in Buin," *Oceania,* Vol. 5, 1934-35, pp 119-131.

[3] Furness, William H., Jr., *The Island of Stone Money,* Philadelphia, 1910.

The fei are stone wheels, discs of white limestone which have holes cut in the middle to permit the insertion of poles, by means of which they are carried. These discs are not made in Yap, but are quarried and shaped on the island of Babelthuap, one of the Pelews, some four hundred miles away. From Babelthuap they are brought to Yap on canoes and rafts.

The value of the individual fei depends technically upon its diameter, measured in finger-spans from thumb-tip to the tip of the index finger. The monetary value of these symbols is, therefore, a linear measurement, in terms of a unit which varies with the individual anatomy of the measurer. There are other considerations, however, which render it even more variable. If the disc is off-color, or too coarse grained, or poorly carved so that it is imperfect in shape, its value decreases accordingly.

The smaller fei, no more than eighteen inches or two feet in diameter, being fully portable, are used for buying pigs and fish. The larger ones are used in transactions involving the sale of many pigs, or in similar high financial exchanges. Many of the larger ones are too heavy to be moved without much effort, and hence the new owner will leave it standing in front of the house of a previous owner, or wherever it happens to be. The oral transmission of ownership is enough security—possession is not necessary. One very famous stone was lost overboard early in the last century, on the way to Yap; no one has seen it since. Its ownership, however, is still valid; it is still on the market, a negotiable commodity.

In a community like Yap, where everyone knows everyone else, the ownership of a large stone, under the sea or elsewhere, is an important factor in the determination of total social position for reasons to be discussed later. The German administrators, who governed the island before the Japanese took it over, were well aware of this fact; in order to make the natives pay or work off their taxes, they went about the island painting black crosses, to indicate government ownership, on the fei. Only after the taxes had been paid would they remove these marks.

The fei are too valuable, as a rule, to be used in minor commercial negotiations. A three-span disc, some eighteen inches wide, is worth approximately a good-sized pig or a thousand cocoanuts. A good fei about four feet wide is the price usually paid one village by another when the boys of the first kidnap a girl of the second to be their mistress in the men's house. For minor negotiations, involving neither pigs nor women, as a rule, shell money and mat money are used.

The lowest unit of shell money is the *botha-ayar,* seven shells strung on a cord at intervals of about five inches; after each group of seven comes a cowrie shell, to indicate the division. The individual shell must have the

hinge and the opposite edge intact; the sides may be trimmed. These shells are approximately three fingers wide. The next unit is an individual large pearl shell, which must also have its outer edge intact. A shell one hand-length in breadth equals one *botha-ayar,* and each finger-width beyond that, it doubles in value. These individual shells, like the botha-ayar strings, are never used as ornaments. They are true money. Four of them, as a rule, are placed on the body of an important man or woman as a funeral offering.

The next unit in the monetary scale is the *umbul,* or banana fiber mat, woven in varying lengths, but with a constant diameter of approximately five feet. These mats are very old, and have not been woven for a long time. They are never seen, because they are kept rolled up in matting cases which are not opened. Hence the people who own and exchange these mats are not certain of their appearance. They measure the mats by finger-spans, measuring the diameter of the roll, as with the fei. An ordinary-sized mat usually equals the largest of the pearl shells, or a three-span fei.

There is still another form of money, or exchange token, which falls into a different category. These are the red shell necklaces which are not sold, but which are loaned in return for services. A person can buy the privilege to wear them for a time, but cannot actually purchase them. Their ownership is, therefore, a permanent endowment, like the ownership of landed estates or inherited capital, held in trust and untransferable, like the estates of some of our older families in America.

The third example, that of the Trobriand Islands, shows an entirely different use of shell money.[4] This use is brought about by the extreme specialization of local industry which makes Melanesia unique in primitive society: In the Trobriands, the natives of Omarakuna specialize in producing excellently carved woodwork; those of Murua in greenstone, for cutting tools; those of the Amphletts in pottery, and the Dobuans in sago. These four divisions of the Trobriand area are composed of normally hostile tribes, and trade in these commodities conducted on a purely economic basis would be difficult.

This trade is made possible by means of the Kula exchange system. In accordance with this, individual men from each island have entered into a formal exchange relationship with individuals on neighboring islands, and pay each other formal visits at stated intervals. Everyone is not involved, only special people, arranged in pairs of partners. The symbols which they exchange are (1) red shell disc necklaces, which move clockwise around the circuit of islands; (2) white shell armbands, which move in the opposite direction.

[4] Malinowski, B., *Argonauts of the Western Pacific,* London, 1922.

The technique of the exchange is that partner A will prepare with elaborate ceremony for his visit to partner B; he may even build a special ship for this specific voyage. He sets sail with his followers and lands at B's island, where he gives B a red shell disc necklace. B receives his partner and gift with suitable ceremony. Then A goes home. Later B visits A, giving A a white shell armband with equal ceremony.

The Kula objects are never worn as ornaments, and they are never used to buy things with; they are not really money. They are, however, old and prized pieces, for each single necklace and armband has its individual history, which is known to all members of the circle, and they look forward eagerly to receiving them in turn. These objects are so highly symbolized that they cause emotion on the part of those who handle them. The best known objects which are comparable in our society are the silver cups awarded to winners of athletic contests on successive years; the kind of cup that has the names of all the winners engraved on it, and which no team or individual keeps permanently before the expiration of a certain period. The Davis Cup might serve as an example of a symbol exchanged internationally; and the America Cup. Both these cups, however, go to the winner of a contest; it is not predetermined who shall have each every year.

The Davis Cup and the America Cup perform—or performed—the function of building up friendly interaction between nations, and that is exactly what the Kula exchange system does. Under the aegis of the Kula exchange, the pottery from the Amphletts, the sago from Dobu, the greenstone from Murua, and the fine woodcarvings from Omarakuna were distributed to their markets. The parties to the exchange consider, of course, the Kula-swapping to be of paramount importance, and the economic exchange incidental. This is an excellent example of the fact that people, by and large, do not understand the true purposes of their own actions.

The use of non-monetary symbols was not limited to the Trobriands. In the kingdom of Benin, in West Africa, the units of exchange were (1) the cowrie shell, brought to Africa from the Indian Ocean by European mariners, and (2) the *pagne,* or standard length of trade cloth. These units of exchange were government controlled; they were issued as our government issues money. Furthermore, the king had a quantity of coral beads, made into necklaces and headdresses, which he issued to noblemen as tokens of rank, and which remained the king's property, which he could revoke, since the nobility was not hereditary.

In the Northwest Coast region, where the famous potlatch system was in operation, units of exchange, aside from shell money, were blankets and "coppers." A "copper" is a sheet of copper hammered into a shield-like shape,

with a raised T-shaped rib in the middle. The coppers passed from hand to hand in ritual exchanges, and could even be broken along the ridges and used as fractional currency, just as a *farthing* was originally a fourth of a penny in a literal sense. These coppers, however, resembled the Kula symbols in that they were used only for ritual exchange, and in that the individual pieces were all well known, like old masters, which gave them a symbolic value due to a large extent to their association with former owners.

3. True Money—The Single Unit of Exchange. In the Buin district of Bougainville, in Yap, in the Trobriands, in Benin, on the Northwest Coast, and everywhere else that shells, mats, blankets, copper plates, and so forth are used, there is never a single unit of value; in each case there are two or more groups of negotiable symbols in circulation. The groups of symbols are usually interrelated in some general way, but the rate of exchange is not absolute; the condition of the symbolic objects themselves is important, and furthermore, if the objects are also subject to consumption (taro roots, pigs, cocoanuts, lengths of cloth, bars of salt, etc.), their market value in terms of scarcity and abundance may shift the equation. On the whole, it may be said that the development of a single unit of monetary exchange does not exist without coinage.

Currency in our sense, however, did not exist in the earlier urban civilizations of either hemisphere. The Egyptians and the Babylonians carried on their trade negotiations in terms of standard weights and measures of staple commodities; so did the Peruvians. The Aztecs and other Mexicans used cacao beans as mediums of exchange, but these were perishable, and, furthermore, capable of falsification, since it was not difficult to sift the cocoa powder out of the shell and refill it with fine earth. They were also a consumable medium, and not one which could be issued by the state. Small copper hoes, probably brought up from Peru by coastal trade, were also used in Mexico as currency, especially in Oaxaca, as were quills of gold dust.

According to Herodotus, metal currency was invented by the Lydians. At exactly what period this invention was made is not stated. We know, however, that metal coinage began to circulate around the eastern end of the Mediterranean during the seventh century B.C.; the Greeks were especially active in its diffusion. The Chinese, who issued stamped blocks of gold, may have invented it earlier than the Aegean peoples; in China, the history of coinage parallels that in the Western World.

Precious metals form the optimum medium of monetary exchange for several reasons. They are naturally uniform: i.e., one ounce of gold is like another. They can thus be cast into units of standard size and weight. They

are portable and easily concealed. They are nearly imperishable and resist wear. The metals themselves are difficult to obtain and limited in quantity; hence a small coin is worth much in commodities; furthermore, the value of metal fluctuates less on the market than does that of such perishable commodities as livestock, vegetables, and textiles. Furthermore, coins often have an esthetic value.

The earliest metal coins were standard quantities of given metals, on which the seal of some political authority had been stamped. This seal symbolized the fact that the coin contained the expected amount of metal; a merchant using units of this metal as standards of exchange would not need to weigh each piece of metal that passed through his hands. Stamping coins was, therefore, a political authorization to make the coins acceptable.

In Greece, each city-state had its own coinage. The same was true of China; each provincial capital exercised this privilege. In China, the issuance of local coinages continued down to the present century; in the Mediterranean region, the Romans made the right to coin money the exclusive prerogative of the Emperor, during the latter part of the Empire. During the Middle Ages in France and Germany, some of the more powerful nobles coined their own money; in England from Saxon times onward, however, the king alone retained this privilege.

Peoples who use metal coinage select one metal as standard, and if they use other metals as well, peg these to the standard metal at an arbitrary value, and thus employ the coins made from the secondary metals as tokens. The Romans, in the early days of the Republic, used copper as the standard, but they soon found it too bulky for extensive exchange. The Spartans, during the period of their greatest power, used iron. In the rest of the Mediterranean region, the standards were either gold or silver, the imperial Roman standard being gold. The monetary systems of Europe, built up on that of the Roman Empire, have likewise been historically systems in which gold was the standard, while in China the standard is and has been for centuries one of silver.

In all countries on the gold standard, the value of the gold coin bore a close relationship to the market value of gold. Usually one tenth to one twelfth of tin or copper was added for hardness, and the quality of the gold was evaluated in terms of this dilution. Most governments, faced with the expense of minting the coinage, charged the public for this service by setting the value of the coin above that of the raw metal. The one great exception to this rule was the British government, which minted gold at its bullion value. The right of the government to make this charge, which England did not exercise, is known as *seignorage.*

Seignorage profits, however, were made by all governments in the token coinage of grosser metals; the values of the half crown, florin, shilling, and sixpence in England, and of the silver dollar, half-dollar, quarter, and dime in America, have never approached the bullion value of the silver. Nickel and copper similarly are worth much less than their coinage value; however, the public using these coins seldom realized the fact that there was only about thirty cents' worth of silver in a dollar, even in the most prosperous of times. In Europe, the issuance of aluminum coins in many countries brought the token character of the coinage into prominent view.

One reason for the issuance of token coins of baser metals is that fractional coinage of gold, or even in some cases of silver, produces coins that are so small that they are hard to pick up and are easily lost. The old United States silver three-cent piece was impractical for that reason. On the other hand coins that are too large are easily altered; it is possible to hollow out the inside and fill it with baser metal. Our silver dollar is as large a coin as most governments are willing to issue, for that reason.

There is one essential difference between coins based on the value of their metals and token coins. Coins that are worth their metal value may have a circulation outside the political authority of their own states, while the token coins are valid only inside the domestic boundaries. The old silver and gold coins issued by the Greek states were used in many countries, since they represented a true metal value. In the same way, the Austrian Maria Theresa silver thaler, bearing the date 1796, although issued for more than a century later, was the standard in Ethiopia until 1935, and still is in the kingdom of Yemen.

If a coin is to be exchanged on its metal value, some precautions need to be taken to prevent clipping, filing, and other methods of reducing the metal content. Milling the edge is the most effective system; this was not done, however, until late medieval times. Pure token coins of nickel, copper, etc., need not be subjected to such precautions, since the metal of which they are made is of little value.

Paper money, observed in China by Marco Polo and introduced into Europe somewhat later, is the next stage in the history of token money beyond the coinage of base metal. The use of paper money is a substitute for the issuance of gold coinage; theoretically there is a dollar's worth of gold bullion in the treasury for each paper dollar issued. The abuse of this system is obvious and easy; the economic consequences disastrous. During the last two decades all of the great nations of the Western World have gone off the gold standard, and the paper money which they issue symbolizes the political authority of the state, and its responsibility to its citizens.

Debasing the coinage did not begin with 'paper' money; an earlier method was to adulterate the metal of the coinage. This adulteration was soon detected, with the result that the value of the coinage fell to its metal value. Paper money furnishes a wider opportunity for depreciation; paper pulp and ink are all the materials necessary.

III. FINANCE

Once ways of estimating units of value are developed, it becomes possible for the individual trader to try to make a good bargain. He can do this particularly if he is able to move about and take advantage of the different rates of exchange in various places. From what evidence there is available in the accounts of various peoples, it seems that most of them were sharp traders when they were operating with commodities with which they were familiar. The rather startling stories which one reads or hears about the naïveté of the primitive are due to their lack of familiarity rather than sheer lack of ability. Once they catch on to the system, they can trade with the best.

With the development of trade, the concern with profit became greater, because the trader in his relations to his customers was ordinarily but one point in a complex chain of exchanges. Once he became a full-time specialist, depending upon the exchange of commodities for his living, the living had to come out of his profits, and he had to make the distinction between his gross and his net. The conception of profit and loss as an index to the equilibrium of institutions developed in urban civilizations: in Mesopotamia first, and later in Greece and Rome. Where the money standard was developed, all transactions could be reckoned in terms of standard units, and the volume of trade and the percentage of profit were early estimated. More complex notions arose with the development, almost simultaneously, of the idea of interest, namely, that the differences in the interaction in completing an exchange could be estimated in terms of units of value.

There are essentially two types of exchange: (1) simple exchange, and (2) the credit and interest system. Simple exchange is the type of operation in which most peoples living in the simpler societies indulge. The silent trade and weekly market systems are good examples of simple exchange operations. Normally the goods are handed over simultaneously; when there is a time gap between the reciprocal actions, the concept of credit is involved.

Usually, in cases of credit, the parties to the exchange have some agreement which limits the time element involved. In Benin, for example, the king's mercadors used to extend credit to American or British captains of

slavers, giving the slaver a full cargo on the understanding that he would bring back the price in cash, cloth and rum on the following voyage. In the Kula system, one exchange partner gives a necklace, but must wait a period of months before he receives the complementary armband. The time interval which elapses is limited by custom.

Credit implies that the person who makes the loan puts his wealth out of circulation until it is returned to him; this temporary deprivation may cause him some inconvenience. On the other hand, he has done his partner in the operation a favor. For this reason, the partner may make him an additional gift when he returns the money. In the Buin district of Bougainville, a debtor when he returns shell money adds anywhere from ten to fifty percent, or else gives his creditor a pig. In ancient Sumeria, the temple priests would loan seed grain and oxen suitable for plowing to farmers, and when the return was made, the farmer left a present for the god in the temple.

The realization that the time involved in completing the exchange transaction has to be reckoned into the trade is at the basis of interest. The gifts made by the native of Bougainville, or the Sumerian farmer, show a recognition of this principle, but not of the idea that time should be measured and the gift standardized on that basis.

Exchanges made on the basis of interest, like simple exchanges, occur both in economic and political institutions. In societies which operate without metal coinage the political use may be more important, but, as in our society, exchange transactions are found in all institutions, and the most important is the one having the highest frequency. Two well-known examples of the use of interest outside an economic institution are those of the Sukwe society in the Banks Islands, and of the Northwest Coast Potlatch system.

In the Banks Islands[5] of Melanesia, in the Torres Islands, and in the northern New Hebrides, each village has a clubhouse located in the middle of the village. This clubhouse is open in front, and anyone can see inside clearly. Inside, it is divided into sections which are separated by horizontal poles; the sections are raised progressively from front to rear. These sections symbolize rank in the Sukwe society; each person sits in the section to which he has obtained admission. Usually there are eighteen sections.

The boy, whose parents wish him to enter this Sukwe organization and start his social climb upward, must have a sponsor, who is usually his maternal uncle. The uncle decorates the village square and gives a feast and

[5] Codrington, R. H., *The Melanesians,* Oxford, 1891; Rivers, W. H., *The History of the Melanesian Society,* Cambridge, 1914.

dance for the boy. At the feast the uncle gives a half-fathom of shell money to all persons invited, and they must give him a whole fathom in return. With this money, the uncle pays for the boy's admission into the lowest rank of the society. In order to get enough half-fathoms to initiate this unequal exchange, the boy may himself loan out some money for a month or two at 100 percent interest; he can double and redouble his capital several times in this way. Once he has entered the society, however, he loses this privilege.

As he climbs higher and higher in the society, he gives money to all in his village who belong to the rank above him, and since everyone in rank 18 also belongs to 17, 16, 15, 14, and so on down, the higher he climbs the more he collects, and the less he gives. The last few ranks, furthermore, are intervillage in scope; a man of rank number 7 or higher will receive gifts from everyone on the whole island who seeks to attain the seventh level.

The Sukwe system, which uses standard Melanesian shell money as a symbol of exchange is a system directly comparable to that of the Mumi but is institutionally organized. In it, a rich man may push his sons ahead more rapidly than a poor man may; it is also closely linked to the normal age cycle, in that hierarchical position is increased in a visible symbolic as well as interactional manner with advancing age. It utilizes the principle of interest, but merely as a method for boys to make a beginning at the critical stage of starting their social careers.

The Sukwe system illustrates in concrete financial terms the whole process of rising in institutions in most societies, and helps to clarify the situation in societies where this process is carried on much less formally, and in which many of the peoples who are involved fail to realize objectively what is happening to them. Stating the problem in general terms, it is clear, in the first place, that the reciprocal character of gift-making controls the building up of relationships between individuals. A person of inferior status must go through a long period of originating action by giving gifts to those above him if he is to climb the social ladder. It takes a long time, ordinarily, for a person who is originating action to the person immediately above him before he can interact in a less asymmetrical way and can originate to the same person to whom he makes the gifts. These actions which he has been originating go against the stream, they flow counter to the current of action which normally exists between the giver of gifts and his superior in a hierarchy.

A man who wishes to rise in a hierarchy spends much of his effort in making gifts, either of cash, goods, or services, to his immediate superior. When he attains equality with the latter, the relation becomes reciprocal,

and he starts over again originating action to his new superior, one grade higher. In a large hierarchy where people do not know each other intimately, a climber of this type often rises to the top of large and important organizations, whether or not he is competent to perform the functions of leadership. A man who wishes to strengthen his relationship with those below him and insure the strength of the hierarchy gives to those below him, and the latter thus learn to terminate regularly to his origins. In turn, they originate to him in pair events with a high frequency. Thus a good politician never neglects the interests of his constituents. On the other hand, a man in a high position who wishes to widen the gulf between himself and his inferiors can do this easily by distributing gifts and by refusing to interact in pair events with them. As long as he maintains this order of action, there is no means by which they can hope to balance the relationship, and thus he can only enhance his own prestige.

For example, in Marrakesh, a rich Arab merchant steps outside his front door every Friday morning before going to the mosque, and distributes small copper coins to a long line of beggars who assemble there. His neighbors remark on his pious generosity, and the beggars leave him alone at other times. Large gifts to charities in our own society often produce a similar gulf between the givers and the recipients.

Returning to the subject of interest, we may examine the operation of the Potlatch system among the Indians of the Northwest Coast.[6] One type of Potlatch is that in which the boy seeks to acquire the rank of his father. As in the Sukwe system, the boy is allowed to borrow at low interest for the purpose of launching himself socially. He can start without capital, since he may borrow blankets to begin with at a rate of 100 percent per year; during this year he loans them out again over and over, at 200 percent interest per month; at the end of the year he can pay back his debt with interest and still have enough to pay for his initiation feast and begin his regular financial career. He usually starts by borrowing 100 blankets, and making a profit of 400 or more.

From the time that he has assumed his seat in the men's council onward, he has the privilege of distributing blankets at 100 percent interest a year, like the other grown men. This is done usually at feasts to which individual capitalists invite their rivals. At this feast, the host distributes gifts, usually in the form of blankets, which the recipients must match on the spot, to show that they are financially solvent. A year later, the gift must

[6] Boas, F., "The Potlatch of the Kwakiutl Indians," from Report of U. S. National Museum for 1895, pp. 341-346, 358-359, in Kroeber & Waterman, *Sourcebook of Anthropology,* New York, 1931.

be repaid at 100 per cent interest. Besides blankets, the objects given may include canoes and the famous coppers, as well as slaves. An incident in this system is the competitive destruction of property, which has been known to include the killing of slaves.

Northwest Coast rates of interest are more clearly worked out than those of most pre-literate peoples. The normal scale is as follows: for 12 months or more, 10 blankets for 5; for between 6 and 12 months, 7 blankets for 5; for less than 6 months, usually 6 blankets for 5, although this is variable, and for very short periods, no interest is usually charged.

These loans are used not only in Potlatches, but also in ordinary commercial transactions. A man who is in need may pawn his name for a year; this transaction with incorporeal property involves a special high rate; for 30 blankets, he has to pay back 100 at the end of a year. The interest rates, although fixed to a large extent, are not completely comparable to ours. For example, in our civilization if a man borrows money at 6 percent per year, he may be able to get an extension. Among the Northwest Coast Indians he must pay on time or he will be disgraced; he will have failed to complete his half of the reciprocal action and will be as debased as the Marrakeshi beggars. There is no question of a loan's being regarded purely from the point of view of return on one's investment.

From situations such as these, there develops the idea of credit, namely, the expectancy that a particular individual will complete his part of an exchange. In the cases just dealt with, there is little development of credit except in the initial loan to a young man starting out, and this, of course, operated within the family system. Where these violent struggles to rise in institutions, and to build up followings, took place, it was the chief concern of the contestants in these financial operations to reduce each other to bankruptcy, i.e., to a state where he had no credit whatever. The situation was exactly comparable to that which we saw in the case of the Social Climbing Feast in Siwai, with the exception that everything was reckoned in terms of financial units and the procurement of wealth to use in social climbing could be obtained by financial operations something like ours.

Good credit and bankruptcy are at opposite poles in financial operations. Good credit is the result of a high frequency of exchange in which each transaction is completed exactly according to schedule. If a man was due to repay 100 blankets at a certain date, he would have them ready. He might even improve his credit by returning them earlier. If with increasing frequency, time lengthens between the transactions, and elsewhere than on the Northwest Coast, the debtor fails to repay on time, then his credit begins to weaken. When finally his credit begins to be exhausted, and he

is no longer able to get new loans to take the place of the old, and when his creditors together begin to dun him for money which he is unable to pay, then his only recourse is to admit he is, or is to be declared, bankrupt, that is, one who is unable to reciprocate in exchange transactions any longer. He is then forced out of the system until such time as he can build up a little profit through strictly cash (i.e., immediate exchange) transactions, and begin again.

We shall not deal here with any of the more complicated procedures in modern finance, involving differences in interest rates on the basis of the difference in the time of the note, of discounts and rediscounts and so on. Nor shall we deal with the high development of the logic of accounting during this century, and in the use of systems of accounting, based on the profit and loss conception, by which an internal control on the costs of manufacture for each department in a factory is maintained with a high degree of value for administration. All of these systems are merely complex variations adapted to fit complex institutions in our society on the simple exchange transaction. It is this reciprocal relation involving balancing origins between individuals which provides the basis for most of the interaction in many institutions. As we have seen in Chapter 15, it is the velocity of transactions in the trader-customer, or commercial, set which controls the rise of economic institutions.

IV. CHANGING VALUES AND THE INTERRELATIONS OF INSTITUTIONS

In simple exchange, where no evolved system of money is used and where interest is unknown, changes in the abundance of certain products, or in the ease with which they can be produced, bring about changes in relative values. The adjustment is a relatively simple one, and is usually made directly by trader and customer. In highly organized societies in which money is a symbol without a material negotiable referent, such as grain or gold, its referent becomes the credit of the government which guarantees it. When the credit of that government deteriorates, the money loses its value correspondingly.

In the same way, the value of shares in a company depends on the strength and probity of that company; if a company manufactures a product in constant demand, if its credit is good and if it has an efficient organization, the paper securities which represent its capital may rise in value. Trading in these securities may cause fluctuations in value on the basis of all sorts of extraneous factors such as the credit or warlike achievements of

its government; thus the market value of a stock has little relationship to the amount of profits made by the company.

The credit of a company, however, must in the long run depend upon its maintenance of the exchange relationship with its stockholders; its payment of dividends and bonuses enhances its value, and hence the value of its securities; the non-payment of dividends and bonuses leads to a loss of credit, and hence a real loss in market value. Credit is always important in any financial transaction; the technological and the symbolic aspects of the exchange process cannot be separated.

In the field of technology, modern progress in the production of manufactured goods, and in their distribution, depends greatly on the adoption of international units of exchange. Each sovereign power in the world, comprising an independent political entity, has its own currency and its own standard of monetary value. But since the world is greater than the separate nations of which it is composed, and since trade institutions are often international in character, it may be truly said that some economic institutions are larger than the recognized political institutions. Owing to this discrepancy between the economic and the political systems, it is necessary for individuals and organizations dealing in international trade to equate the currencies of the countries between which they operate.

International exchange is not limited to the countries having metal and paper currencies. It also reaches out into the realm of shell discs and blankets. In Bougainville, one fathom of shell money of the ordinary type is worth an Australian shilling; in the days of the efflorescence of the Potlatch, a common white trade blanket (of English manufacture, incidentally) was worth exactly fifty cents in Canadian or American money.

The European nations which flourished during the period which ended in 1914, had gone far in the field of equating national currencies. France, Spain, Italy, Switzerland, Serbia, Greece, Bulgaria, and other countries had formed the League of the Franc, in which the standard unit of currency was worth twenty cents in American money, or one franc, one peseta, one lira, one dinar, or whatever. Gold, silver and copper coinage of these countries passed interchangeably. In those amicable days before the First World War, a traveler in France might find in his pocket change coins from five or six different countries.

Nothing is so sensitive to political disintegration as the symbolism of money. With the First World War came a disturbance of political institutions, and hence the League of the Franc speedily collapsed. It is interesting to note that in a debased form it continued for over ten years in one country, Albania. Albania, with no commonly accepted coinage of its own, used the

assorted silver of pre-war European countries, plus an occasional American dime or quarter. These coins were evaluated on the basis of their worth as bullion, and hence in 1929, the crown, as the francs, liras, dinars, and so forth were called, was worth approximately seven cents. Stray Americans visiting Albania were startled to receive American ten-cent pieces in change for seven-cent purchases. The American dime was worth approximately three and a half cents; persons who intended to return to America kept them. The other coins, however, belonged to nations which had long since passed on to aluminum and paper.

During the interbellum period, some curious things were done in the field of international finance. In Russia, the ruble was worth what the government wished to charge for it; it cost Americans fifty cents, but would buy a half a box of cough-drops. For this reason the government operated *valuta* stores, in which foreigners could buy food and other products for English, American, or German money at reasonable prices. Germany and Italy both made fantastic adjustments in their currencies; with tourist marks and tourist lira, travelers could live cheaply in Axis territory but could remove no Axis currency. The natural results of these financial manipulations were: (a) the development of a black-bourse by which exchange between currencies was made on an illegal basis which reflected their actual values, and (b) the collapse of international commerce. In the history of money as a symbol of exchange we may read the history of the expansion and contraction of political systems.

SUMMARY

When people carry on trade or exchange they have to devise some means of giving each other relatively equal values in terms of commodities. The easiest way to do this is to devise standard units of exchange. These units will be most effective if they are uniform, universally useful, of esthetic value, relatively imperishable, and easily portable. People in various places use units which meet some of these requirements but not all, as for example cocoanuts, cattle, pigs, and bars of salt. The best of all from this standpoint is metal.

There are three systems of exchange: (1) Without Units of Exchange, (2) With Multiple Units, and (3) With a Single Standard. Only the simplest food-gatherers and other subsistence peoples get along without standards of exchange. Where there is any volume of trade at all, some such units have arisen. People who use shell money, as in Melanesia, and such units as cocoanuts and salt bars, have several commodities, each of which serves as a separate set of standards. It was only with the beginnings of coinage in Asia

Minor, Greece, and China that people came to develop a single standard. This is essential for complicated business transactions. People who use coinage have one metal as a standard and use the others for tokens.

In financial transactions there are two kinds of exchange: simple exchange, which most "primitives" employ, and the credit and interest system. People who do a lot of trading and finance, like the Northwest Coast Indians and some of the Melanesians, have developed the system of setting a fixed value on the time elapsing between the beginning and close of a transaction. This development has its beginning in an extra gift with a delayed payment, and its end in the full-blown interest system.

Credit and interest systems are used in both economic and political institutions; in some cases they are used as a means of advancement in political hierarchies. In our society an economic or political institution will have "credit," a value which depends upon its relations with its stock-holders or constituents and upon the efficiency of its organization. The great elaboration of credit and interest transactions in our society are complex variations adapted to suit complex institutions.

Units of currency are usually controlled by the state, and unless the state is on a single metal standard, so that the exchange varies with the market value of the metal, international exchange depends upon the "credit" of states. When the world is in a state of relative equilibrium, exchange is stable; as in the days of the League of the Franc before 1914, when coinage was interchangeable in many European countries. When political institutions are in a state of disequilibrium with each other as well as internally, exchange fluctuations and such phenomena as tourist marks and valuta, and the black bourse, appear.

CHAPTER 28

Law: Symbols and Techniques of Preventing Disturbances of Equilibrium

I. INTRODUCTION

We have seen throughout this book how institutions from time to time attain a state of equilibrium, only to be thrown into disequilibrium by some crisis arising in the internal or external relations of the group. When such a disturbance has occurred, there are specific techniques and symbols which have developed whereby the system, temporarily at least, can be brought back towards the state of equilibrium. This symbolic configuration we have called Ritual, and we have examined its workings in some detail in Part IV.

But in every group of people, another symbolic configuration is found, equally important, which helps to maintain the system in its state of equilibrium and to prevent disturbances from arising. This configuration is called Law, and as in the case of Ritual, it is made up of techniques and symbols, and has developed a system of logic of its own.

It may be thought that the emphasis of trial and punishment would lead one to an alternative explanation, namely, that the law is concerned with restoration of equilibrium after a breach, but it can be easily shown, and in fact has been pointed out by students of the law over and over again since the publication of *The Common Law* by Oliver Wendell Holmes in 1881, that the interest of the law is in defining the kind of behavior a "reasonable man" ought to manifest in given situations. The legal machinery is set up principally to determine whether the facts in a given situation indicated that the defendant had or had not acted outside the limits of tolerance defined for the interactions of individuals. By reaching a decision, the court then states that such and such behavior was permissible because previous decisions had so defined it; such and such other behavior was not. Such a statement then provides a precedent for future decisions. The various types of punishment in both civil and criminal procedure are merely ways of conditioning the individual to the required behavior or of removing him, and of indicating what the results will be for others who fail to act in the way

defined by law. This is the reason for the well-known legal statement that ignorance of the law is no excuse. In other words, everyone has to act in accord with the ways of behavior set down by the court or other legal authority in order to maintain the system in its state of equilibrium. Anyone acting in such a way as to disturb this equilibrium must be taught not to do so again.

Although we shall discuss the logic of the law later in this chapter, one further point may help in making clear what follows. One reason why it is clear that the law is not concerned with the restoration of equilibrium can be derived from its insistence, largely enforced through the stabilizing effect of political institutions, that everyone is equal under the law. According to this, then, no matter how important a person is in the institutional framework of a system, he is nevertheless to be punished if he commits a breach of the law, however serious a disturbance the punishment may create. The head of a great economic institution, the leader of thousands of followers, who might kill a wandering tramp in a fit of rage, would be put to death, even though the institution he headed and all the tangent institutions would be seriously disturbed. Yet there would be in fact no disturbance of equilibrium after the death of the tramp. It is true that these reasons would no doubt be adduced by counsel for the defendant, but they would only appear in an appeal for clemency, and would not alter the fact of the guilt. Restoration of equilibrium, therefore, may or may not result from legal procedure. It often does occur, as in the case of restoration of property unlawfully obtained, but even in such a case the guilty person is forced to act in ways defined by the limits of the system; he is conditioned to "good" behavior.

Laws, then, are symbolic descriptions of uniformities of the interactions of individuals in given contexts of behavior. They specify not only the orders, frequencies and rates of the interactions of persons, but also the way in which elements of the contexts of situation, objects, techniques, land, and so on which are associated with the interaction must be dealt with in order to maintain the equilibrium. They result from the process of symbolization just as ritual symbols and language and other symbolic configurations with which we have dealt in Part V arose—from uniformities in the referents of the group. The meaning of laws, like the meaning of words in a language, is developed through the fact that a large number of people respond to the symbol in a particular way. Once the referents begin to change, the meaning of the law becomes confused, as does the meaning of a word, and alternative interpretations are common until such time as the referents again become stabilized in the behavior of a large proportion of the group.

This fact provides us with a convenient distinction between law and

custom, a difference which has been the subject of endless discussion. In American legal theory, the term law is dependent upon the existence of an institution charged with enforcing it; such a definition has little relevance outside of the range of complex societies. As Malinowski has pointed out, whatever word is applied, the same phenomena exist in a society without judicial institutions and in a society possessing courts, lawyers and the other complexities of this sub-system within the political institution.[1] The distinction between a law and a custom is merely in the extent of its application. *If it symbolizes the pattern of interaction for all the members of a group, we shall call it a law; if it is limited to the members of an institution or to part of an institution, it is a custom.* The test of law or custom primarily depends upon observation, therefore, and consists of the determination of the extent of its application in the behavior of individuals in different institutions in a group. The existence of an institution for enforcement is irrelevant, because many institutions enforce their customs through a sub-system which, however, does not extend outside the institution itself. Both laws and customs, then, consist of formulations of the ways of behaving through which the equilibrium of an institution or a society is maintained. Any breach of law or custom is followed by action on the part of the group, whether institutionalized or not, to prevent by conditioning any further breaches by the individual in question or by other individuals. But this action is secondary to the principal concern, which is the determination of the law itself by which conduct is to be guided.

II. LEGAL PROCEDURE—THE TECHNIQUES OF LAW

In this section we shall concern ourselves with legal procedure, or the technique of law. Law is, in fact, action rather than abstraction, as Cardozo and others have pointed out. This action or sequence of actions of which law is constituted is usually divided into two parts: the discovery of the law and its application.

The Discovery of the Law. The discovery of the law is the legal term for finding out what is the habitual procedure in a given circumstance, so that it may be determined whether an individual accused of producing a disturbance has actually done so or not. There are two principal ways in which the law may be discovered, by legislation and by precedent. Laws so discovered are called statute and common laws, respectively.

1. Statute Law. When a change in the habitual interaction rate of individuals takes place, owing to changes of environment, technology or people,

[1] Malinowski, B., "Introduction" in *Law and Order in Polynesia,* by Hogbin, H. I., London, 1934.

disturbances will begin to arise so that a change in conditioned behavior is necessary. At such a time, whatever law-giving body there may be in the society may make laws to prevent these disturbances by penalizing those responsible, or to readjust the system of relations of the group so that further ones will be avoided. A good example of this procedure occurred in our own society as a result of the invention of the automobile. Since the use of this means of transportation has become common, many disturbances between individuals in our society have been caused by accidents, injury to persons, property damage, etc., through the use of this vehicle. The various state legislatures have enacted a great number of laws to be followed in these situations. Among other innovations of a far-reaching nature, they have made it legal for officers of the court to serve a summons on the Secretary of State of any state in the United States, who may mail it to the offender, instead of on the offender in person, who at the time of service may well be outside that state. Before this rule was made it was possible for a person to avoid appearance in court if he could avoid the process server by leaving the territory in which the court had jurisdiction. Under the present system he is held responsible for an appearance whether the process server can find him or not.

As a second example, derived this time from environmental rather than technological change, we will cite the passage of a statute regulating the claims on land during the settlement of Iceland by the Norse in the ninth century A.D. When the Norse arrived, the island was unoccupied; each householder took the land he wanted, provided that no one else had arrived there first, built his house and laid out his fields. In Iceland the most desirable land was along the rivers and near the shore, since much of the interior is covered with lava and hot spring deposits. As more and more settlers came, good land grew scarcer. Hence when people took more land than they could hold, others tended to encroach on their claims, and many disputes arose. So the law-men of the island, meeting in the Thing, passed a law that a man could claim only as much land as he could carry fire around in one day. This is, of course, an ample amount of land, particularly when one remembers the length of the summer day in Iceland, but at the time the law was passed most of the best land had already been taken.

2. *Common Law.* The common law, established by precedent, ordinarily changes more slowly than statute law. Common law, indeed, is the body of customary practices which have attained legal status. A dispute is brought before the court, and it is the role of the defendant or defendant's counsel to try to prove that the cases are not comparable, or the plaintiff's counsel to show that they are comparable. The court then reviews the evi-

dence of the cases cited and makes a decision. In the case of common law, the discovery of the law and its application are accomplished consecutively in a single sequence of actions.

For an example of the discovery of common law, we shall again turn to Iceland. In *The Saga of Burnt Njal*,[2] a case is described in which, during a famine, a whale washed ashore on a particular piece of beach. The people who held the land proceeded to cut up the whale and eat it, and tried to prevent their neighbors from coming in to share the windfall. The neighbors, however, insisted that they had a right to it, and, therefore, brought the case before a Law Man who served as judge in Icelandic society. The Law Man said: "*I recall a case in point.* My grandmother bought land from old X, and gave him an old cloak, and this was held to be a binding transaction. In this case, however, nothing was given in return for the land, and the people who occupy it have no claim to the whale."

This is the essence of the discovery of law by precedent. It does not matter whether it results from an attorney looking up cases in a book, the Icelandic Law Man recalling a case in point, or a group of old men sitting around a campfire in Australia discussing what to do about the incest committed by X. Whoever is in authority determines the habitual procedure by reference to past example. Every effort is made not to create new rules, but rather to find a precedent to fit a situation which has changed from the old order. "My grandfather always did it this way," is the basis for judgment, although sometimes an action of an almost forgotten ancestor may have to be brought in to fit the case.

The Codification of Law. At a certain point in the progressive complexity of societies when conflict situations have become more or less continuous owing to an increase in the kinds of interaction between individuals, it becomes necessary for people to codify their laws, that is, to make a list of laws which can be recited upon suitable occasions, or read. For example, the great Babylonian law-giver, Hammurabi, in constructing his famous Code, did not "make up" laws; he determined what was the customary practice, i.e., the common law, in the community in which the law was to be enacted. His laws, then, were codifications of the common law, of customary routines of interaction. When the Normans codified the laws in England, they did exactly the same thing.

Among illiterate peoples who have codified laws, it is necessary for special individuals to memorize them, so that they may be recited on suitable occasions. As can be easily seen, the recitation of habitual ways of behavior is eminently suited to condition the members of the group. The Galla pro-

[2] *The Saga of Burnt Njal*, translated bv Dasent, Everyman's Edition, p. 25.

vide a good example of this. During the annual ceremonies which accompany the age-grading rites of these people, the class being initiated has to recite a different set of laws each year for four years. Although the complete list of these laws has not been recorded, they are known to include the regulations which govern the behavior of the upper-class people (who go through the initiation) towards their inferiors, the *tumtu* and *faḳi,* their behavior toward pregnant women, the property rights of different classes of people, and the transmission of the Rites of Passage to the next class below them.

By the recitation of these laws, which the members of the class have had to learn by heart, their future behavior can be assured through conditioning. A higher stage of complexity than this, in which each adult male is supposed to learn all the laws, is reached among peoples who have more numerous kinds of conflict situations than the Galla, and need specialists to memorize them and to recite them on occasion. The Polynesians, the Inca, and other pre-literate peoples with complex civilizations had such professional specialists. This professional development reached a high level among the pre-Christian Celts, both in France and in the British Isles. In Ireland, every royal court, whether of local kings or of the Ari-Rí, the High King of Tara, had its corps of legal experts. The head law-reciter, called by later historians the Doctor of Laws, was a man of highest rank and was seated in the place of honor at formal banquets, directly opposite the king. Under this Doctor of Laws was a numerous body of underlings and aspirants, graded in seven ranks. It took the lowest of them twenty years to qualify. Just as the legal profession was specialized in this and similar societies, so the laws themselves were cast into a fixed form, which was rendered immutable by being in verse. The law-reciters, therefore, memorized long poems which differed from the epics memorized by other specialists in content but not in form. The laws recited by the pre-Christian Irish have been committed to writing, and are known as the Brehon Laws. They have formed the basis of later legislation in Ireland.

The traditional law of the Berbers, a complex system followed all over North Africa, was originally oral, as was the common or Anglo-Saxon law, on which our own system is based, and also the Adat, or traditional law of the pre-Islamic Turks. It is very likely that, despite the mention of the tablets on Mount Sinai, the bulk of the laws propounded in Leviticus were originally oral.

Writing was, when first invented, as great a boon to the legal experts as to the businessman. The Babylonians committed their laws to writing on clay tables and stones; the Code of Hammurabi has by that means been

preserved for us. Writing not only relieves the experts of the trouble of performing tremendous feats of memory; it also renders legal forms permanent. Our written laws are full of archaic language; our statute books also contain many laws enacted centuries ago to meet local conditions of the time, and never repealed. In a pre-literate society, laws no longer applicable would be forgotten.

Whether a law is assigned to the common law or is enacted by statute of a political institution, it consists primarily of statements about behavior which must be followed by all the members of a group. Such and such actions and interactions must be followed under such and such conditions. Failure to do so is a breach of the habitual way of behaving, and results in the disturbance of the equilibrium. Law-givers as well as the other individuals in a group ordinarily recognize as laws only those statements which deal with practices which help to prevent such disturbances.

In agricultural communities, for example, a considerable legal framework grows up to regulate the interrelations of the agriculturalists and to prevent disturbances to the routine agricultural techniques. In the Rif, for instance, a man who owns a terrace which can only be approached through another man's field, is not allowed to harvest his crop until his neighbor has finished, and thus provided a passageway. The law in this case is designed to prevent loss from trampling of the grain in getting access to a man's field, and the legal question which would come before the council in the case of infringement would be: first, the statement of this principle; and second, the determination of whether or not the particular field in question could be placed in the category stated under the law; and third, whether or not the man did in fact cut his grain before his neighbor had finished. In a country like the Rif, where food is so scarce and arable land at such a premium, the number of minute regulations of this sort testifies to the disturbance any loss of crops would entail, a loss which would be inconsiderable to a Dakota wheat farmer.

On the other hand, American experience with Prohibition indicates that the ordinary purchase and consumption of alcoholic beverages clearly did not represent the kind of behavior which disturbed the equilibrium. Attempts by statute to enforce Prohibition were completely flouted and had to be abandoned because the general opinion was that no harm came from a glass of beer or a cocktail. *But,* and this is most important, there has been no repeal of statutes forbidding the driving of an automobile under the influence of liquor. This is clearly a type of activity which may ordinarily result in serious disturbances, and public support is given to the efforts of the police and the courts to reduce the frequency with which this kind of viola-

tion of the law occurs. As we shall see in the next section of this chapter, the development of legal principle is the result of applying this test to each law, a test which under ordinary circumstances is validated by the kind of system existing in any group. Riffian land law would be inapplicable in the Dakotas, just as American corporation law is completely irrelevant to the needs of rural Irish economic institutions, even though many of the latter might be "corporations." The concern of legal specialists, lawyers, judges, and juries is to formulate laws which will in fact prevent serious disturbances of equilibrium, or to modify existing laws to fit the new circumstances. This is done, however, within a framework of categories erected in terms of the breach of the law, which we must now consider.

Enforcement of the Law. Laws can be empirically recognized by the fact that a violation is followed by origins of actions on the part of individuals in the society to the person who created the disturbance. As we pointed out in the introduction to this chapter, if the rule is limited in recognition and in the action that follows a breach, to the members of a single institution, such a rule can be properly called a custom. If, on the other hand, it is required behavior for all the members of a group, it is then a law. A custom of a family may, for example, merely be that dinner is held at a particular hour; the breach of such a custom might call forth reprimands from the head of the family to the guilty party. Such a custom is, however, of no concern to anyone outside the institution, and the infraction calls forth no reaction from any other institution. If no reaction takes place within the family, however, dinner at eight is neither rule nor custom. Ordinarily the recognition of such a custom will depend upon the extent of the relationships disturbed by the failure to prepare the meal at the stated time.

Obviously much effort can be wasted upon attempts to define law or custom, unless it is recognized that such a definition is, like all the others we have to deal with, primarily a question of quantity. In other words, how often and how regularly does the action follow the breach? The degree of regularity will determine the importance of the custom or law in helping to preserve the equilibrium against disturbances. If in the family instance above mentioned, the reprimand followed regularly whenever the meal was late, we could regard the custom as important in the constitution in the equilibrium of the family, and we would no doubt find that a serious disturbance resulted if it was not adhered to, as in the family of a train conductor who has to leave for his train immediately after the meal. If the action were irregular, however, we could not only regard the custom as unimportant, embryonic, or whatever word we wished to use, but we could

self. The session is secret; none of the younger men or women are present. The elders determine guilt not so much by what the accused says, as by the way in which he says it; they consider, for example, that a man who can laugh during such an ordeal must be innocent.

Among the Eskimo, who are organized in small local groups or bands, the accused does not appear at his trial. A person who is considered obnoxious by his relatives and neighbors is killed after a secret consultation between the rest of the members of the band. After they come to an agreement, some individual is designated to carry out the sentence. White officials have made much trouble for the Eskimo on this score, since they do not recognize the Eskimos' need to preserve equilibrium within their own bands, or their right to self-government.

So far we have dealt with societies in which there is no developed political institution. In societies of moderate complexity, however, it is the head of the state, the personnel of Class A in the hierarchy, who have charge of trials. In Homeric Greece, the king and his council would make all decisions; in ancient Ireland, it was either the local king or the High King, the Ari-Rí, who rendered justice. Even in the modern kingdom of Yemen, the Imam Yahya keeps open court all day long every day, and will hear all cases which are brought to him. There are other legal mechanisms in the country, including local administrators empowered to hear cases, and Moslem judges, but the Imam is the last court of appeal, and anyone can come before him who wishes. Since, however, it takes considerable bribery to get past his various guards and secretaries, the number of suppliants is kept within reasonable limits.

In societies where there is no king, but where the government is in the hands of a council, it is usually the council that conducts the trials. In the Rif, for example, when an offense has been committed which disturbs the equilibrium of more than one clan, the members of the Asht Arbain, the council of the valley or canton, assemble to render justice. They do not, however, usually conduct a trial; they sit in a circle outside the house of the accused and debate how much his fine shall be and what shall be done to his property. If, however, there is any doubt as to his guilt, this will be debated extensively. The accused does not, however, appear personally to plead, but his case is upheld by his friends and kinsmen. Here the trial is conducted by the head or heads of the political hierarchy, who also have direct charge of the government as a whole. In more complex societies, one may find the development of special judges apart from the administrative ranks of the government who conduct the trials.

Most Moslem peoples, including the Riffians, also have judges as well

as the direct political leaders. In each Riffian tribe, there is an official judge, appointed by the tribal council, and holding office for life or good behavior. He must be a man who has studied in a recognized mosque which teaches Moslem jurisprudence, or in a Moslem university. He receives a fixed annual salary, in livestock and staple agricultural products, from each *fifth* of the tribe, and also a small present of meat and sugar from each contestant. Further gifts would be considered bribery. He decides cases which concern the ownership of property, examining the papers of the contestants in case of disputes over land. Both contestants must agree to come to him as umpire—there are no police officers to bring anyone to him. Cases which involve violence or bloodshed are brought before the political councils, as we have observed before.

In Ethiopia, there is a custom by which two litigants in a case over property may agree to stop a stranger on the path, or on one of the streets of the capital, if they happen to be in Addis Ababa, and ask him to decide between them. The city has a number of booths specially built for the use of such litigants and their judges. The pagan Icelanders, whose deeds are recorded in detail in the sagas, used to take their cases before some man of prominence, or, in cases of particular importance, they would go before the annual meeting of the Althing, which still survives as the Icelandic parliament, or before one of the smaller Things. In the early days, it is apparent from the evidence of the sagas, the decisions made at the Thing depended to a large extent on the number of retainers and allies a contestant had with him, rather than entirely on the fine points of his case.

In the New World, there is only one instance in which a society developed special judicial officers—that of the Aztecs. Even the Incas did not have them, but allowed judgments to be made directly by officials of the political hierarchy.

The Aztecs, however, had an elaborate system of graded courts. Small offenses within the clans were settled by the clan elders. Troubles between merchants were settled by a special judge within the merchants' guild, and quarrels that arose in markets were taken before a council of twelve elderly men who sat there each market day. Civil suits, however, came before the regular court system. In each of the four quarters of the city there was a local court. There was also one in each district outside the city. These district courts, inside the city and outside, sat every day; each consisted of a president and two judges under him, all noblemen, and three bailiffs to execute sentences. The judges wore a special dress, and were supported on the produce of special lands set aside for their use. Above these district courts was a court of appeals, in the emperor's palace, which also had a president

and two judges. This court, which met in secret sessions, not only tried cases appealed from the district courts, but also had the sole jurisdiction over noblemen, who could not be brought before the lower chambers.

The court of appeals was the highest court to which commoners could go; if found guilty of capital crimes, they were executed at once. Noblemen, however, could appeal to a supreme court, which consisted of the Snake Woman (the war leader of the Aztecs) and thirteen elders. It is said that cases tried in Aztec courts were recorded in writing, but this could not have been done in great detail, owing to the imperfection of the writing system.[3]

The Aztec system is strikingly similar to that of highly organized modern states; they had divorced the courts from religious sanctions and had also made them independent to a major degree from the ordinary political hierarchy. They lacked, however, special lawyers and jury trials, which are found in only the most complex of Old World societies.

Jury trials in Europe go back to the time of Solon; they reappeared after the Dark Ages, in medieval times. The medieval jury differed from ours in one important respect: the jurors were always chosen from the same community as the accused and knew all about the case beforehand. They were, in other words, a representative body of the peers of the accused. In their decision, they were undoubtedly concerned as much with the preservation of the equilibrium of the society as with the true guilt or innocence of the accused. The modern jury, which is supposed to be completely anonymous, and from which a juror will be excluded if he knows the accused or anything about the case, represents a further specialization in the legal system.

An example of the development of progressive complexity in a legal system is that of the rise of various kinds of courts in medieval England.[4] Under the Normans, the courts of the King's Bench were established to relieve the king of the burden of hearing increasingly numerous cases, and the judges appointed to these courts passed on matters which later came to be known as both legal and equitable; they judged offenses against the person and against property. In making their judgments they had the right to assess fines and set the amounts of damages, and to give reliefs later considered as equitable.

At first these courts were directly under the king's control, but as institutions developed in complexity, the courts became more specialized and passed out of the king's supervision. Furthermore, the law became more formal and rigid after the provisions of Oxford in 1285 which limited the

[3] Thompson, J. Eric, *Mexico Before Cortez,* New York, 1933, pp. 107-111, 126, 132.

[4] Holdsworth, Sir Wm., *The Makers of the English Common Law,* Cambridge, 1938.

kinds of cases which these courts could hear. Hence in order to obtain relief in cases which these courts could not try, people again went directly to the king or his chancellor, and the chancellors developed the courts of equity. These courts could not award money damages, like the King's Bench, but they could constrain a person to do their bidding through threat of jail.

These courts of equity in turn became detached from the king and developed into a separate system. Conflicts arose between the king's courts (King's Bench) and the equity courts, so that in the time of James I rules were established delimiting the powers of each, and establishing the precedent that a judge in a court of equity could enjoin a plaintiff from bringing a suit in a king's court. This was necessary, as otherwise a person might get opposing decisions from the two kinds of court. Parliament meanwhile had been growing in authority as the need for more laws arose, and under the Stuarts the House of Commons acquired legislative powers.

In our own society of the present day, we have seen this development in the complexity of legal institutions extend to the point in which we have a complex series of courts with differing jurisdictions, arranged hierarchically. Beginning with district courts, we have a super-imposed system of county, state and federal courts, at the top of which is the Supreme Court of the United States. The regional system is further differentiated by courts dealing with separate areas within the law, courts of probate, land courts, admiralty courts and the like. During the last ten years, many administrative bodies have taken on quasi-judicial activities, and there is developing what is called administrative law, the rules of procedure of the independent boards of the government, such as the Interstate Commerce Commission, the National Labor Relations Board, and so on. We shall mention these once again in the final section of this chapter.

III. PRINCIPLES OF THE LAW

Once a number of laws have arisen within any group, there is always a question of knowing which of these apply under given circumstances. In the course of argument by contesting parties before the political leaders of the group or before the court, each side will be sure to bring up cases decided in the past which favor their point of view, which they claim will apply to the case at issue. For example, in the case of the stranded whale in Iceland, the holders of the land tried to argue that possession of the land entitled them to exclusive rights over any property found upon it, while the Law Man based his decision on the fact that the holders of the land had only squatters' rights and these disallowed the right of possession which had to be acquired by transfer.

In such a case, the question arises as to the legal principle which shall determine the choice. This is the result, of course, of the fact that individuals interact in different institutions. An heir to his father's estate may also be a debtor to a corporation. Can the estate be claimed by the corporation to satisfy the debt? Our legal system, as worked out in the institutional framework of a complex society, is primarily concerned with finding the principles by which the individual's behavior can be defined. It is, therefore, the job of the courts to settle the areas of conflict by defining what is permissible behavior, and to determine the general principles from the laws which are in existence. Even in non-institutionalized societies, the development of these principles occurs, but the area of conflict is much smaller.

The principle of permissible behavior is at the bottom of all legal questions, therefore, and it can be defined by saying that what the courts endeavor to ascertain is whether or not the conduct of an individual (that is, his actions and interactions) was such that a disturbance of the equilibrium would naturally result, or whether the disturbance of the equilibrium was not the result of his actions. Holmes illustrates this principle by giving the example of a man about to throw a heavy piece of timber from the roof of a building. If he throws the timber over without crying out, and just as a man with whom he is known to have had serious altercations is passing, then he is committing a murder. If he throws the piece of timber over on a busy street after crying out to warn the passers below, then he is guilty of manslaughter if the timber kills anyone. And finally, if he throws it over in an enclosed yard fenced off to keep people out, where every precaution is taken, then any resulting death is accidental.

In each of these instances, the end result is the same, a man is killed. The question, however, is, which of these cases is actionable, that is, which is an infringement of the law. The principle which is the accepted rule for decision is that only those cases are excluded from the category of violation of the law where the action under ordinary circumstances would not have been followed by a disturbance. In the third instance, the circumstances were such that homicide would not ordinarily have followed; therefore, the death was not a crime. The fact that the law is not concerned with the restoration of equilibrium as such is shown by the fact that the disturbance was the same in each case, yet the legal liability differed in each case, and in fact, in the last case there was no liability whatever. The restoration of equilibrium after the death is the province of the religious institution; it has nothing to do with the legal aspects of the homicide.

This illustration serves further as an example of several subsidiary legal principles, one of which is the definition of criminal liability. In each

instance, the overt act was the same and, therefore, no grounds for legal differentiation were possible. Nor could there in fact be any inference as to the state of mind of the individual at the time he committed the act; he was alone and no information was available. However, in each case, the situation differed objectively. In the first case, the possibility of disturbance of the equilibrium (through the death of the passerby) was very high; in the second, it was fairly probable that on a busy street someone would be passing by and that circumstances would be such that his warning cry would be insufficient to avoid an accident; in the third case, the probability was extremely low that anyone would be around. From the point of view of law, each of these probabilities was objective and could be calculated by the ordinary individual. It was, therefore, at his own peril that he performed the act; the doctrine of the reasonable or prudent man, which Holmes was the first to enunciate widely, means that laws apply to all individuals in the society who are judged to have the same potentialities as to their ability to avoid disturbances of equilibrium.

In the trial for homicide, it is up to the defendant or his counsel to show evidence that the individual in question did not fit into this category, i.e., that he was not a reasonable man. He might be insane or a child below the so-called age of reason, or he might be acting in a state such that he had justifiable cause for the homicide. It would be a little hard to use this example as a case of the latter, but if a man, when attacked by an armed man, wrested the gun from him and killed him in the process, it would no doubt be reasonably argued that self-defense was the excuse. If the armed man were an officer of the law, however, the excuse would not apply, since again the reasonable man, within the workings of our institutions, would not expect a police officer to attack him, and no question of self-defense would enter into the argument, unless it could be shown that the police officer were behaving in ways not permitted within the ordinary routine activities of the political institution.

An instance such as this shows very clearly the necessity of abstracting legal principles from the individual cases which arise. This is done primarily from the basic premise of law which we have formulated as the techniques and symbols by which disturbances of the equilibrium are prevented. In the instance given by Mr. Holmes, the legal problem is to differentiate between the three cases, and the grounds for so doing are based upon the subsidiary principles of the reasonable man and of criminal liability. Every branch of the law is based upon similar processes of generalization.

Comparable processes may be found in non-European legal systems.

A. I. Richards gives a good example of this from the Bemba.[5] A case was brought before the Citimukulu's court (the head chief of the Bemba).

On this occasion the head man of village A on one side of the river complained that villagers from B on the opposite bank had crossed the stream and cut gardens in the bush immediately near his village instead of cultivating on the other side. Citimukulu heard the case at some length, but gave his decision without hesitation. He declared that no action lay, and dismissed all the litigants. He said to the assembled court; "they are all my people. It is my icalo (territory) and not the icalo of others! No. Let them cut trees wherever they like! It is I who am the owner of the mpanga (river). It is not your river! No. Let them work to find food, and then let them bring tribute here, millet and Kaffir corn and beans. Let them bring tribute of all. Are they not all my people?" The statement that it was everyone's duty to produce as much food as possible, and to give tribute to the chief, was clapped by all the councillors present, and the hereditary priest, Cimba, the oldest man present, when specially consulted on the subject, said; "Yes, that is just how it was in the old days. It was always the same. The people made gardens wherever they liked, and brought food to the chief."

In this instance then, an action of trespass was ruled contrary to the sovereignty of the Citimukulu, and the action of the people of the village in crossing the river and cultivating on the other side was, therefore, not regarded as a disturbance of the equilibrium of the group.

The most extensive fields of legal principles—contracts, torts, succession, crime, and possession—are all equally concerned with the problem of preventing disturbances in the equilibrium of groups. We can only briefly mention the areas of prevention with which they are concerned. Crime we have already discussed as our principal example, and torts, the problem of civil liability, is directly comparable but includes many types of action which result in harm to an individual or a group. Possession deals with the relationship of individuals and groups with the objects, techniques, and so on which are the constant elements in institutional contexts of situation. These include land, houses, tools, animals, right to symbols, and so forth. Succession, which includes both transfer of property and rights to positions within given institutions, includes both transfers upon the death of an individual and transfers among the living. The purpose of laws dealing with succession is to regulate the transfer in such a way as to prevent disturbances of equilibrium. If a man is the heir to an estate, the problem of prevention of disturbances of the equilibrium is to see to it that every interaction is regulated

[5] Richards, A. I., *Land, Labor, and Diet in Northern Rhodesia,* Oxford University Press, New York, 1939, pp. 266-267.

so that the heir will succeed without contest. Contracts are somewhat similar to torts, in that they are concerned with determining liability for a harm. Unlike torts, however, the liability is not that which is defined by the system of relations of the group in question, but one which is defined by an agreement between individuals. The questions arising thereunto are thus concerned with the performance of actions and interactions to which two or more individuals have agreed.

Space does not allow a systematic discussion of the principles involved in each one of these general areas where disturbances of equilibrium are to be prevented. What we have done is merely to illustrate the process by which the principles come to be defined, and to show in a single instance that the general considerations of the law are definable in terms of the equilibrium of individuals. Since, however, these interactions differ in different societies, and in the same society at different periods of time, the process of formulation of the law is continually undergoing change. What the courts are engaged in doing is, in fact, trying to give a systematic definition of the institutional structure of a group so as to prevent disturbances of its equilibrium. What is a disturbance at one period of time and in one particular group will not be a disturbance at another time and in another group. In the following section, we will give a few illustrations of this point.

IV. THE DEPENDENCE OF LAW UPON THE STRUCTURE OF SOCIETIES

In the Bemba example of an action for trespass brought before Citimukulu, we saw that they had a definition of possession which would not hold in our own society. This definition depends upon the nature of their political institution, which include an hereditary ruler and subsidiary chiefs, all of the same clan. Within the political institution, there is a high frequency of origins of action from Citimukulu. The political system is defined by Richards as "autocratic." Coupled with the high frequency of origins of action in the administrative set was a system of agriculture which we have already described, which depended not upon the fixed and regular cultivation of a given plot of land, but rather a slash-and-burn type of agriculture which involved the temporary use of a piece of land, then its abandonment for a period to lie fallow, until brush grew up again which could be burned and provide the ash necessary to fertilize the fields. Under such a system a doctrine of trespass and ownership grew up to describe what the habitual relationships of individuals should be in order to avoid disturbance, and this had little resemblance to that which would obtain among ourselves or among the Riffians.

Changes in legal principles from period to period within any group have been well documented for our own legal system and its antecedents in Anglo-Saxon, Frankish and Roman law. One example will illustrate not only how a change in the system of relations produces a change in the law, but also how the change in law may involve a reinterpretation of an existing formula to fit the new facts.

In discussing succession *inter vivos,* the Latin phrase for "among the living," Holmes points out that the relation of buyer and seller in English law derived from an extension of the method of inheritance within the family. Although the fact of exchange was a common matter, its legal symbolization did not develop within the sphere of exchange itself, but rather as incidental to the process of transfer within the family. Here a symbolic system by which transfer could be accomplished had already been worked out. Its application to exchange depended upon establishing a legal fiction of kinship. In the Salic law, for example, a man could transfer his property by delivering it to a trustee who within twelve months handed it over to the beneficiary. These the text called those whom the donor had designated as heirs. In *The Saga of Burnt Njal,* to which we have already referred, there is an example of a lawsuit being handed over by the family to a stranger for prosecution, and the stranger, who acts as attorney in our sense, took over all the rights to the suit, "as if he were the rightful next of kin," and this phrase had to be incorporated into the transfer. Ultimately, of course, the symbolization of kinship between the buyer and the seller, or in the case of Burnt Njal, between the attorney and his clients, was dropped out. It served its purpose as a fiction (symbol) by which two situations could be judged equivalent if their referents had relatively similar quantitative aspects. This is a process which we have discussed in detail in Chapter 19. Legal reasoning is to a large extent dependent upon this process of determining equivalence.

With the development of complex societies, and in particular with the development of complex legal institutions, there is a continual change in the law as the makers of the law endeavor to fit the legal framework to the facts. We have already referred in the first section of the chapter to the way in which courts in the common law, and legislative bodies in the statute law, make the law. Their efforts are largely concerned with the determination of the relationships between individuals as members of institutions and the definition of the limits within which these relationships are controlled. The process of historical change has been accompanied by progressive changes in the emphasis of legal systems. In the Middle Ages, for example, most law was concerned with the problems of the relations

between church and state, and between those institutions and the family. At the present time, we have witnessed a vast development of law dealing with economic institutions and the regulation of the activities of the individuals within these institutions. Corporation law, during the first three decades of this century, had a rapid and strenuous development coincidental with the development of the modern corporation. During this past decade, we have witnessed a sudden development, almost from nothing, of what is now being called administrative law, the law made by the different agencies of the government independently of the legislative bodies, the Senate and the House of Representatives, and the Courts themselves. The present controversy as to the definition of the relationship between law made by these bodies, the Interstate Commerce Commission, the National Labor Relations Board, the Veterans Administration, and the already existing institutions for law-making is consequent upon the rapid growth of these administrative agencies during the period of change in the administration of President Franklin D. Roosevelt. In agriculture, in industry, in transportation, and in a host of other fields, the incidence of disturbances during the late twenties, resulting in the depression of the early thirties, brought about the development of agencies to stabilize the equilibrium of our country. Once this equilibrium began to be reached, laws began to appear which would define the interactions of individuals in such a way that further disturbances would be avoided. The success with which the definition of these laws is accomplished will determine whether or not a stable system of relations will be developed within the next several decades in this country. But such a process has to go hand in hand with the process of defining a system of relations which can operate efficiently. No matter how well the laws formulate the existing relations of individuals, if these relations are not in a state of equilibrium, the ingenuity of definition of lawyers and judges is bound to be of no avail. Only if such a process of legal definition is accompanied by effective engineering in the field of human relations will the legal system reinforce the existing system in this or any other country.

SUMMARY

Just as ritual helps restore equilibrium, so law helps maintain it. Laws define the kinds of behavior a "reasonable man" might be expected to follow. The legal machinery is set up to determine whether or not the accused has acted outside the limits of tolerance defined for the interaction of individuals in a state of equilibrium. Punishment is a way of conditioning the individual to the required behavior, or of removing him so that he can-

not continue or repeat the disturbance. It also serves to show others what will happen if they break the law.

Laws are symbolic descriptions of uniformities in the interactions of individuals in given contexts of behavior, resulting from the process of symbolization. The meaning of laws is developed through the fact that a large number of people respond to the symbol in a particular way. What is law in one society is not in another; the laws depend on the adjustment of a people to their environment in terms of their technology and institutions. In any society in which there is more than one institution, a distinction may be made between law and custom: law is the system of rules for a society as a whole, custom for a single institution.

Legal procedure includes the *discovery* of the law and its *application*. The discovery of the law is simply the process of finding out the habitual procedure in a given circumstance. There are two ways of doing this: by the creation of a *statute* law, made by a law-giving body at the time of disturbance to meet the new conditions, and by the establishment of the *common* law, or law of precedent, by which the court or judge finds a precedent for a similar case in the past.

The application of law consists of the determination of guilt or innocence, the sentence, and the execution of justice. The determination of guilt has nothing to do with the fact that a disturbance was created; if the action of the accused fell within the bounds of reasonable behavior, he is not guilty no matter how great the disturbance he may have caused. If he passed these bounds he is guilty, whether or not a disturbance resulted. You are just as guilty each time you drive through a red light, whether your action in so doing results in an accident or not. However, if you are carrying a dying person to a hospital and pass through it, you can usually do so without punishment, since reasonable behavior is measured by the degree of probability of creating a disturbance *under ordinary circumstances.* This principle is the same in all societies where legal systems are in use, and it applies to all phases of the law, including criminal law, torts, contracts, succession, etc.

At a certain point in the progressive complexity of societies, when conflict situations have become more or less continuous because of an increase in the kinds of interaction between individuals, people begin to codify their laws; i.e., to list them in formal language. Illiterate peoples who have codified laws recite them on stated occasions to be sure of remembering them, and to condition others to obey them. In the more complex societies which also have no writing, special men do the memorizing and reciting. Writing, of course, greatly facilitates codification and all other legal procedure,

In the simpler societies the determination of guilt is made by the head or heads of the institution affected. In more complex societies special judges arise, who are paid fixed fees and render decisions as umpires. They do not, however, handle suits involving bloodshed, which still go to the political heads. In still more complex societies, as that of the Aztecs, separate courts are created to handle classes of law and they are divorced from the regular administrative hierarchy of the political institution. As societies increase in complexity, so do the courts; as areas of conflict and disturbance continue to arise, laws are continuously being made and new institutions arise to take care of them.

CHAPTER 29

Science: Symbolic Representations of the Relationship Between Phenomena

I. INTRODUCTION

The beginnings of science are to be found where people are able to abstract from their technical processes generalizations about the relations between phenomena. Among the simplest groups, we have little evidence other than that provided by their technology of the knowledge of principles of the several sciences; we do not know (and we very much doubt from other evidence) whether the people who made the admirable torsion traps described in Part II were able to formulate explicitly the principles on which they worked. Nevertheless, there seems to be no reason why we should not assume that they knew empirically, that is, by the fact that it actually worked if you made it right, what the general idea was behind it.

In many ways, then, the history of science could be restricted to a survey of the principles utilized by men at all stages of their technological development, and many people have, in fact, so treated it. Nevertheless, we have already given an account throughout Part II of the various principles utilized in the development of technology, and no useful purpose would be served by repeating them here. Moreover, it may be justly argued that the principles embodied in the several technological systems that we have discussed are not necessarily to be regarded as science. Rather they represent the raw materials on which the scientists work. This view, then, and the one we hold to, for reasons discussed in the first chapter, regards science as essentially an abstract account of the properties of phenomena, an account which primarily consists in the measurement of the relations of these phenomena.

If we seek to give an account of the development of scientific generalizations, we have necessarily to concentrate on the simpler achievements, leaving the reader who wishes more particularly to know about the development of mathematics or physics, for example, to consult the books listed in Appendix I. What we want to show is the way in which symbols and techniques developed out of technology by the same process

of abstraction that we have already discussed for ritual and language. We shall thus be concerned with the symbols which refer to technological activities, and the techniques which have arisen from them which have enabled men to generalize upon their technical experience.

II. MEASUREMENT, THE TECHNIQUE OF SCIENCE

The performance of any technical activity requires in the technologist a capacity for making some kind of judgments about the dimensions of the objects he is using. Although he may not pull out his rule, as a carpenter does nowadays, he makes a rough estimate of the length of a piece of wood that he is to use in building a house to see whether it might fit. If he hasn't a rule, he can only fit it by trial, discarding those pieces that are too small and trimming down those that are too big. But the need for anything more than this kind of rough and ready procedure, which ultimately enables the expert to make many judgments intuitively, does not arise in the less complex societies; only where the division of labor has become a matter of more than a few specialists, only where trade is important in the volume of transactions, is it imperative to know how much there is of anything. It is no mere truism to say that the development of scientific knowledge is directly dependent upon the complexity of society. Even if extraordinary individuals single-handedly acquired such knowledge, there would be no chance of its being continued and built upon unless it could be of use to the group in the technological stage in which they found themselves. A micrometer would be useless to an Australian aborigine engaged in making stone spearheads, and a ruler would help him little in building his brush shelter. His results are obtained without any great accuracy in manufacture. The only abstractions which are found on the simplest level are those dealing with number, and their extent is strictly limited by this factor of usefulness.

1. Numbers: Units of Counting

We have already seen in Chapter 24 that most languages possess grammatical means by which they express the concept of number. In most languages, singular and plural forms express the concepts "one" and "many"; in some languages, singular, dual, and plural express "one," "two," and "many"; while in a few there is also an expression for the number "three." One advantage of such grammatical forms is that they render it unnecessary to state the specific number before (or after) each root symbol, provided that the number of units referred to is one, two, three, or "many."

In ordinary conversation, in our own civilization, we are often content

with the term "many" to express the idea of plurality. We will say of a football game: "There was a big crowd," or "I saw many people I knew." We do not determine the exact number of spectators as 10, 356, or any other specific measure. We do not care. We do care, however, how many dollars we have in the bank, how many shirts are in our bureau, or how many sheep or camels are in our herd. Thus while the use of low numbers and plurals alone is enough for most purposes, we need exact numbers, running from one to infinity, for other purposes; the degree of extension of the number system depends on how many units we are accustomed to deal with, and it is thus fitted to our technical needs.

The Ona can count to three, with separate numbers; four is "twice two," and five is a "hand." Ten may be expressed by two hands, and beyond that is "many." Six and seven are actually "many"; twice ten may be an effort in the direction of precision beyond their limits of usefulness. The Yaghans count to three, then hand, then two hands; their limit is even lower. Most Australian languages have no numbers above 3 or 4; 5 and 6 are composites, 2 plus 2 plus 1, and 3 plus 3. The Papuans count in units of 1 and 2, as do the African Bushmen. The latter can reach 10 by such combinations.

Symbols of counting, like other symbols, exist only as they apply to their referents. The peoples named above do not commonly deal in large numbers. The Australian may kill two or three kangaroos in a day; he would not want more, for the meat would not keep. He would prefer to kill one each day. There is little in the cultural context of any of these peoples that requires the use of large numbers. If occasion arises for them to count off 20 to 30 units of anything, they can do it on tally sticks, without the use of spoken numerals at all. Australian aborigines have still another method; a man who wishes to convey the number 15 will point with one hand to successive landmarks on his body, in a conventional sequence, until he has reached the fifteenth; the first 10 will probably be fingers; number 15 may be the navel, or the left ear.

Most of the world's counting is done on the decimal or vigesimal system; this is because we have ten fingers and ten toes. The Melanesians, for example, use fives and twenties as units (quinary-vigesimal); the largest number is usually 400, or 20 times 20. The Maya counted also by twenties, with intermediate units of five. They, however, knew the use of the zero.

Although our linguistic units of counting go by tens and twenties, the next unit above is not always 100; the Babylonians used 60, the Maya 52. There is evidence in the Bible and in modern Hamitic usage that 40 was once also a standard in parts of the region of Mediterranean civilization.

All peoples who count to 10 and over use the decimal system, but some employ a secondary count as well—that of 12, the duodecimal system. We ordinarily buy and sell eggs in dozens, and pairs of shoes in grosses, or dozen dozens. This system is used for most retail commerce which involves such handy units as fruits, loaves, blocks of paper, sheets of cloth, or garments. Beer comes in cases of two dozen cans or bottles. A foot has 12 inches, a shilling 12 pence.

The origin of the duodecimal system may be traced to Babylonia, where the hours of the day were reckoned as 12; this number may have been suggested initially by the months of the year, or by the fact that a dozen of almost anything fits into a box or other rectangular container better than ten. The Babylonian unit of 60 also has its place in our reckoning; we have 60 minutes to the hour, and 60 minutes to a degree.

2. Mathematics: The Abstract Relations of Numbers

Mathematics, other than simple counting, is limited to high urban civilizations which employ writing. The Babylonians and the Egyptians used fractions, and the Babylonians had a place system that permitted decimals. The Babylonians were better mathematicians than the Egyptians; the former had decimals on a scale of 1 to 60—thus .12 would be one fifth, what we would call .20. The Egyptians expressed fractions by drawing a line over the denominator; $\bar{5}$ would be $\frac{1}{5}$. The drawback to this system was that they could only express fractions with the numerator of 1; for other fractions awkward expressions were necessary. Egyptians also had awkward methods of multiplication and division; the Babylonians actually used multiplication tables and reciprocals. The science of mathematics, known to the Greeks, was begun by the Sumerians and elaborated by the Babylonians. The Greeks themselves passed it on to the Arabs, from whom we derived it. Related systems arose in China and India. Wholly independent, however, was the mathematical development of the Mayas. We know that they used the zero, and lacked fractions, also that they were able to calculate relationships between different systems of enumeration. Exactly what methods of mathematical procedure they followed, we do not know; their techniques died with their priesthood.

Early mathematics developed, as we all know, from the use of numbers and units of measurement in the technology of the high urban civilizations. It was no accident that the first subject, other than arithmetic, which received attention was geometry. Euclid's work in bringing together and systematizing the work of the Greek geometers is familiar to everyone, and even a faint memory of school geometry will remind the

reader that geometry is concerned with the abstract relations of points and lines and angles.

Mathematics, however, must not be confused with science, even though all scientific results are ordinarily expressed mathematically. Mathematics is the language of number. Two and two equals four, by convention, although it will often happen in scientific work that two units of something plus two units of something else will not equal four units. For example, if two gallons of water are added to two gallons of alcohol, the result is not four gallons of the mixture, because the chemical interaction of the two during the mixing process causes some of the material to escape as gas. In the same way, a so-called imaginary number like the square root of minus one is logically necessary in the operations of the mathematicians; it has no scientific, i.e., measurable character. The difference between the scientist and the mathematician is that the scientist must demonstrate experimentally that his results are in accord with observation. He is, therefore, limited in his abstractions by the way that his facts behave. The mathematician, on the other hand, is governed by the logical assumptions he makes, and providing his results are consistent with his postulates, he is completely indifferent as to any relation between his results and the behavior of the phenomena in the external world. It happens, of course, that much of mathematics is useful in describing such events, but only because mathematicians have been called upon by scientists to develop logical systems on the basis of the functions they themselves have worked out. However, this is not necessary, and many mathematicians pride themselves on the uselessness of their work. Mathematics is more directly comparable to music than anything else. The mathematician is a composer of numbers. Just as the musician accepts the limitations of a particular scale and builds on that by logical combination, so the mathematician builds on his assumptions. If he assumes that parallel lines never meet, he can build one kind of geometry; if he assumes they do meet, he can build another. Whether or not it is useful depends on the behavior of phenomena. In our school study of Euclid, we all learned that the "straight line is the shortest distance between two points." The geometry based on this assumption is useful for many purposes, but it is manifestly not adapted for travel on the surface of the globe. By making a contrary assumption, Lobachevsky and Riemann each built up a different geometry for curved surfaces, which has recently been found to be of great utility; but at the time that they invented these geometries, there was no scientific reason for developing them further.

3. Units of Measurement

Once a group develops a number system of any extent, it is an easy matter to develop methods of measurement. These are at their basis merely methods of counting units which can easily be distinguished one from another. Perhaps the simplest of these measures are those developed to deal with time; the natural alternation of day and night provides an easy unit to which counting can be applied.

A. Time. Units by which people measure time are based on the regular recurrence of noticeable cycles of change. The most noticeable of these cycles is the *day,* the twenty-four hour period during which the earth makes one complete rotation on its axis. Our whole physiological rhythm is adjusted to this alternation, and all peoples use it, as one would expect, as a basic unit of time measurement.

Within the twenty-four hour period, further landmarks are dawn, sunrise, high noon, sunset, and the onset of night. It requires no system of counting and no scientific apparatus to observe these phenomena. Primitive peoples, living in the simplest cultures, can place an occurrence in time on the basis of these intervals. Greater accuracy, however, is seldom encountered except in advanced, urban civilizations. Every anthropologist who has been on expeditions in countries where watches and clocks are not commonly used knows how difficult it is to make workmen appear on time. The European or American views with contempt the indifference of the Central American peasant, the Arab, and the Balkan peasant to time, in the sense of the hour of the day. Hours mean nothing to such people; they indulge, as a rule, in no activities that require more accurate timing than a half a day. If one visits a railroad station in Ethiopia, one will see natives sitting on the platform waiting for a train that may not be due for five or six hours; American Indians have also been known to come a day early to catch a train. Ceremonies of clockless peoples also seldom start on time, unless they are ceremonies built around the movements of the sun.

Urban civilization, with its specialization of occupation, requires an exact division of the day into predictable units. So does the division of water for purposes of irrigation. Hence the system of dividing the day into hours arose in ancient Babylonia and in Egypt. In Babylonia, the day was divided into twelve double hours, without reference to the rising and setting of the sun. Since the sun's daily movement varied with the seasons, no attempt was made to equate the invariable hours with these movements; only noon and midnight were thus noted. In Egypt, the day was divided into twenty-four hours, twelve of light and twelve of darkness; in the winter, the hours

of night were longer than those of daytime; in summer the reverse was true. This Egyptian system is still used in the kingdom of Yemen.

Devices with which the Babylonians and Egyptians told time included the sundial, in use by day, and the water-clock, in use by night. The water-clock permits a small stream of water to flow from a small hole into a graduated container. The length of time taken to fill the container up to a certain point serves as a unit of time. The principle is the same as that of the hour-glass, which was used in medieval Europe. The Egyptian water-clock, although constant in operation, had to be correlated with the seasonal change in the length of the day; about 1500 B.C., a seasonal correction was invented. In Babylonia this correction was, of course, not needed.

Another kind of water-clock is used in North Africa today in connection with irrigation. A farmer who owns a share in a ditch will time the flow of water into his fields as follows. He places a pot with a small hole in its bottom in the middle of the irrigation ditch. The pot gradually fills and then abruptly sinks. Each time it sinks the farmer quickly empties it and replaces it on the surface of the water; he marks these intervals of filling and sinking by means of stones which he places on the bank as tallies. When he has had his share of water-clock units, he closes his ditch.

The units of time which he employs are not hours; they are simply the length of time it takes a certain pot to sink. No two pots are necessarily, in this respect, alike. However, all the men who own shares in this ditch use the same pot, and for their purposes a complete standardization is achieved. This system of time measurement has nothing to do with the *time of day,* any more than does the use of a three-minute glass in boiling an egg.

Beyond the day, the next unit of time which is easily discerned is the month. This is made apparent by the periodic changes in the shape of the moon, by the incidence of high tides during full moons, and by the recurrence of menstruation. Most, if not all, peoples recognize the lunar month as a unit of time. Among many agricultural peoples, however, its lack of correlation with the solar year makes it useless from the standpoint of planting and sowing, and it has been given up in favor of the artificially created solar month. We, who use the solar month, still retain the week, or fourth of a lunar month, as a primary unit of time; we have three important cycles of occupational change: change within the day, within the week, and by seasons within the year.

The year itself, the period of a complete circuit of the sun by the earth, is a vital unit of time to all peoples living in regions in which there

is a seasonal change in temperature, rainfall, vegetation, and fauna. Only people who live in tropical rain forests, where every day is like the one before, can ignore the interval of the year.

The climatic alternations within the year, which we call the seasons, may range in number from two to four. Occupants of monsoon forests recognize only two: the dry season, when the wind blows one way; and the wet season, when it blows the other. Dwellers in dry lands or scrub forests, when there is a period of seasonal rainfall followed by increasing drought, recognize three: winter, when it rains; spring, when the grass is green and the skies clear; summer, when the earth is burnt and bare, and the sun is hot overhead. In such climates the rains come immediately after the heat and drought; there is no fall. The four seasons with which we are familiar are characteristic of mid-latitude forest regions. In Polar lands, the Eskimo and the Chukchi reckon as many as six seasons, based on the condition of the snow.

From the astronomical standpoint, the four natural landmarks of the year are the equinoxes and solstices, falling on March 21, June 21, September 21, and December 21 of our calendar. Peoples living in middle and high latitudes, where the seasonal differences in the lengths of night and day are great, usually equate their annual ceremonies to these dates. It is at these times that we find feasting, games, and gift-giving. Peoples who live in monsoon climates in the tropics, on the other hand, usually hold theirs at the shift of the monsoons.

The solar month, which all Occidental civilizations employ, is the result of an attempt, or rather several attempts, to equate the unit of lunar time, the month, to the solar year and its segments, the seasons. Such an equation is necessary for agriculturalists, who must have an accurate solar calendar for their planting. The Egyptians, who dated the beginning of the New Year by the rising of the star Sirius, were unable to make an exact correction, and the official year was usually inaccurate. The Babylonians, with no official solar calendar, had a lunar year of 354 days, and the king, on the advice of his astronomers, intercalated a month when necessary.

The Maya used five separate calendric systems: (1) a year of 365 days, with 18 months of 20 named days each, and 5 intercalary days, but with no provision for leap year; (2) a year of 360 days, as above, but with no intercalation; (3) a period of 260 days, called the Tonalamatl; (4) a lunar calendar; and (5) a Venus calendar of 584 days, with 4 days dropped every 61 years for correction. The long count, the cycle of 400 years and grand cycle of 8,000, were based on the second system, the 360 day year. It is this

system that was used to date the Maya monuments; the others served as checks on its accuracy.[1]

Most of the units of time which have been mentioned above are based on the movements of the earth, sun, and moon. Sirius, which was observed by the Egyptians, follows an annual cycle. The Babylonians and the Maya, however, made separate calendars on the basis of the planet Venus, which, in the course of eight solar years, appears five times in the same place on the earth's horizon. Venus calendars are confined to high civilizations; they are too complex for popular use and mark no noticeable time intervals. Their use is confined to priesthoods, who make their predictions to the people as a result of their calculations. In Yucatan and in Babylonia, priests versed in calendric lore were able to predict eclipses and thus win the awe and obedience of their calendrically ignorant followers. In all early urban centers, priests were not content with predicting the cycle of the year, with its times for sowing and reaping, and for celebrating festivals; they thought that if a man could predict some events, he could predict all, and hence the pseudo-science of astrology had its beginning. The priesthoods in Egypt, Mesopotamia, China, and Mexico, were filled with ardent astrologers.

Beyond the year itself, many literate people reckon in larger cycles, dependent usually on their system of enumeration. We count in *centuries;* the Egyptians had a Sothic[2] cycle of 1460 years, which were equal to 1461 years of the official calendar, by which there were 365 days to the year. The Babylonians had 60-year cycles, as do the Chinese; the Maya 52.[3] The beginning or ending of each cycle is usually the occasion for special ceremonies; the Maya, for example, broke all their pottery at these times and built a new layer of masonry on their pyramids.

So far, our review of calendric units has confined itself largely to literate, urban civilizations. Most of the less obvious units were not and are not used at all by pre-literate peoples, whether food-gatherers or simple agriculturalists. Among such peoples, the only unit of universal application is the day. Almost universal is the recognition of the seasons. All peoples vary their cycle of activities to suit the light and temperature changes of the day; all who live in regions of seasonal change of environment follow the wider cycle which this change makes necessary.

They do not, however, need elaborate methods and devices in order

[1] Thompson, J. Eric, *The Civilization of the Mayas,* Chicago, 1936, pp. 45-57.

[2] The Sothic year, based on the rising of Sirius, contains 365¼ days.

[3] Based on the Tonalamatl. In the Tonalamatl, 13 numbers and 20 day names are repeated over and over, each in its own cycle of 13 and 20 respectively. A given combination of a number and a day name will occur but once in 52 years. Thompson, J. Eric, *op. cit.,* Chicago, 1936, p. 54.

to tell the time of year; the hunter knows at what seasons different species of animals are to be found on the hills and in the valley bottoms; he knows when their flesh will be fat and their furs prime. Gatherers know when the seeds of wild food plants will be ripe, when edible roots will be thick and yet tender, and at what season berries will be ready for picking. Fishermen will be on hand when the salmon make their annual spawning excursion upstream, harpooners when the seals stump helplessly about on the rocks during their breeding season.

The methods by which such peoples determine the time of year are simple and effective. Food-gathering peoples can usually do this by observing natural signs; the ripening of milkweed pods, the appearance of the first migratory birds, the budding of the leaves of different kinds of trees, the croaking of frogs, and so on. Farmers who live in temperate regions may use the same indications, but their annual schedule needs to be a little more precise than that of the hunters, and a calendar is a valuable acquisition. Some years the trees bud early, the bluebirds return a month ahead of time; on such years there may be late frosts and crops planted on the bud-and-bluebird schedule may be lost.

It is in low latitudes, where there is little visible seasonal change, where trees are evergreen, and where birds do not migrate, that the measurement of time becomes a serious problem for farmers. In Borneo, among simple slash-and-burn agriculturalists who live on or near the Equator, the time of year is accurately determined by a device called a *gnomon*. Gnomons were also used in Babylonia and in Peru. There the use of these instruments was a part of an advanced calendric lore. In Borneo, the case is different.

The Bornean gnomon is a stick of wood carved in human form, with a pointed foot and a cross stop near the bottom. The shaman who operates this device thrusts the pointed end into the ground at a place where the soil is level and where all vegetation has been removed. He makes sure that the stick is vertical, by means of a plumb-line. At noontime, he observes the shadow which the gnomon casts on the ground. From noon to noon he measures this shadow with a notched stick; when the shadow has grown to the proper length, he tells the people of his village, who proceed with their rice planting. Now they can be sure that by the time they have the fields cleared, the branches and leaves dried and burned, and the rice ready to plant, the rain will come.

The Bornean shaman who operates the gnomon does not know how many days there are in a year, nor why the sun casts shadows of slightly different length at different seasons. He does know, however, that in past

years the day when the shadow fell at such and such a notch was the right one for planting, and that what happens one year is likely to happen on another. Since he does not know why this system works, he makes a mystery of it; scientists who learn by rote and do not know their business have that tendency. In the tribes where this system is employed, the calendar-shaman is the only complete specialist, the only individual who does not have to do some work in the fields.

B. Distance. The measurement of distance has, in human history, been subjected to little standardization. Distance which involves travel, such as the distance between villages or between mountains, is usually expressed in terms of days' journeys, or "sleeps." An African Bushman will express his measurement of distance in this way, and so will an Indian in the Canadian forest. The first implies travel afoot, the second in a canoe. Since no two men walk exactly the same distance in a day, or paddle the same distance, the units are not accurate; a fast traveler may make a journey of forty days in thirty-five. Early attempts at standardization produced the Persian parasang and the Roman *milia passuum* (one thousand paces) or mile. Until the adoption of the metric system, most European countries had independent measures such as the verst, league, and mile. Our mile is standard for the United States and the British Empire.

Linear distance used in manufacturing has had an independent history from that used in travel. The almost universal unit is the span, or fathom, which we have standardized to six feet, measured from fingertip to fingertip with arms outstretched. A six-foot span is normal for a man of about five feet ten in height; at the time when our system was standardized, this was a tall stature. Good measure was apparently desired. Besides the span, subsidiary units are the yard, ell, or cubit, from nose to fingertip; the hand-breadth, the digit, or finger-breadth, and the foot.

In the Solomon Islands, measurements are made in terms of four landmarks between the fingertip and the nose; these are fourths and halves of a yard. The natives who use this system are chiefly concerned with the measurement of shell money, which comes in strings. The standard unit of shell money is a fathom. When asked what they do about the difference in span between individual men, they say: "When buying it, we get a big man, when selling, a small one."[4] This statement, although made in jest, is probably true. Most peoples below the horizon of urban civilizations use the same technique. Each man has his own standard.

The Penobscot Indians of Maine, in building a birch-bark canoe, meas-

[4] Reference is to the Siwai of Bougainville. Private Communication by Dr. Douglas Oliver.

ure the height of the gunwales from the ground at various levels by means of a notched stick. With this same stick they measure the spread of the gunwales at various positions from bow to stern.[5] Each canoe-maker's stick is his personal standard, no two are exactly alike, since each man works out his own canoe shape, just as John Alden and other yacht designers have their own ideas as to the shapes of hulls. The canoe-maker's measuring stick is used more for shape and proportion, therefore, than for absolute size.

The Northwest Coast woodworker[6] measures objects against each other, or by means of sticks, slivers, or cords, cut the right length. If two surfaces fail to fit, he will rub one with charcoal, put them together, and then smooth down the places marked. Each object made has its traditional dimensions, in terms of the carpenter's body, but the carpenter does not rely on these measurements for accuracy. Nor do any two carpenters use exactly the same standards.

Standardization of linear measurements in the Old World began with the Egyptians and Sumerians. In these countries, the unit was the cubit, or yard; this was set at various lengths approximating 18 to 20 inches. The digit, or finger-breadth, was equated to it, usually with 16 digits to a cubit. The Phoenicians and the Romans used as their standard unit the foot; it is from the Romans that we get the division of the foot into 12 inches.

If one studies the units which we still employ in this country and England, it becomes apparent that each was devised for its own use, and that the equation of one to another is a secondary affair. The furlong, for example, was the length of a furrow in a standard field; the yard, a measure used in carpentry, weaving, and the like, with no relationship to the furlong or the mile. Each was devised for its own purpose. The only attempt ever made to equate all these on a convenient conversion scale was the invention of the metric system, which, since it applies equally to area, volume, and weight, will be discussed later.

C. Area. Units of area are less commonly employed by peoples below the urban level than are standards of length; as a rule, one dimension is considered constant or standard, and the other measured in linear units. In this way, Africans and Polynesians would measure lengths of bark-cloth. The Sumerians had a square-measure, še,[7] which bore the same name as a measure of weight; the še, in the sense of area, was the surface of field that

[5] Speck, Frank G., *Penobscot Man,* Philadelphia, 1940, pp. 61-64.

[6] Boas, F., "The Kwakiutl of Vancouver Island," *Am. Mus. Memoirs,* Vol. VIII, Leiden, 1909.

[7] Childe, V. Gordon, *Man Makes Himself,* London, 1936, p. 220.

could be sown with a še-weight of grain. Both the Sumerians and the Egyptians could calculate area by multiplying two sides of a rectangle; in the case of irregular fields, they divided the surface into rectangles and triangles, and calculated the area of each separately, then added them. Their measurements were not over-accurate. Neither are those of our New England fields and woodlots, made before the days of theodolite surveying.

D. Volume. Units of volume, when such units are used at all, are in terms of familiar containers, such as baskets, bags, parflèches, boxes, canoes, and so on. Most food-gatherers and simple agriculturalists do not have accurate standards of volume; many of them have none at all. A Siwai of the Island of Bougainville, when measuring a pig, runs a string around the circumference of its belly at the fattest point, and then expresses the volume of pork in terms of a linear measurement.[8] The history of our own standardization of units of measurements reveals that we still use familiar containers, such as hogsheads, barrels, and so forth, as standards. The Standard Oil Company measures the contents of its reservoirs in barrels, sells its gasoline in gallons.

E. Weight. What was said about area and volume is equally true of weight. Most food-gatherers and unspecialized food producers do not bother with it; it seems to appear about the same time that writing does. The Egyptians, by the beginning of the Old Empire, had standardized weights for the entire country; the Sumerians and Babylonians, however, used separate units for the different city states. Thus, the political unity of a region is reflected in its degree of standardization of measure systems. In China, this is likewise true; each urban center has its own standards. In the New World, the Peruvians used a single standard during the Inca Empire.

The simplest unit of weight is a stone; in Morocco today, official weighers have their standard stones which they use singly and in combination. The instrument of weighing used in Moroccan markets is the balance, or steel-yard; balances were employed throughout historical time by Egyptians and Mesopotamians. In the New World, the Peruvians invented it independently. China and Japan are also old centers of its use.

F. Temperature. The measurement of temperature is entirely a product of the modern age of science. No primitive peoples, no urban scientists of antiquity, ever devised a technique for its measurement. Galileo invented the thermometer in 1612. Since it is such a recent device, it is small wonder that only two systems of heat measurement, Fahrenheit and Centigrade, are in use in the world.

[8] Personal communication, Dr. Douglas L. Oliver.

Measurements and Culture. The history of the development of standards of measurements provides one of the best scales for the evaluation of human culture that can be found. Peoples who have little specialization of labor use no integrated standards; their units of spatial measurement are based on the individual human body, their units of time measurement on the alternation of night and day, of the moon, and of the seasons. The great advance in the development of standards comes with urban civilization, with its state-controlled agriculture, its public buildings, and its extensive manufacturing and commerce. Metrical standards which might apply to many individuals were developed only in Egypt, Mesopotamia, India, China, Mexico and Peru.

The next stage beyond that reached in those centers of early civilization was the development of the metrical system, by which the unit of linear measurement was set at one ten-millionth of a quadrant of the earth's circumference as drawn through Paris. This unit is the meter. By adopting, through international agreement, a system based on measured distances on the earth's surface, the work of map-makers, etc., was considerably facilitated. The principal advantage of the metric system is that it is a place system; all units of measurement in a dimension can be easily translated into one another. Thus a kilometer is a thousand meters; 15 kilometers is thus 15,000 meters. In the English system, instead of moving the decimal point and filling in the zeroes, to turn 15 miles into feet, we have to multiply by 5280, which takes time and affords greater opportunity for error. Almost all scientific work is done in terms of the metric system, largely because of its uniformity in terms of decimal units. In England and this country, we use the standard inch, with decimal divisions, in machine work; but we have not translated our longer measurements into this system.[9]

III. SCIENCE: THE DEVELOPMENT OF ABSTRACT KNOWLEDGE

With the development of number and units of measurement as the symbolic configuration of technology, it became possible for science to come

[9] It must be made clear that the virtue of the decimal system does not lie in the choice of the number ten as a basic unit. Almost any other number between 5 and 20, let us say, would do as well. In fact, 12 would probably be better, since 12 is divisible by 2, 3, 4, and 6, while 10 is divisible by only 2 and 5. Therefore, more fractions in a duodecimal system would come out even than in a decimal; one third, for example, would be .4 instead of .3333 ad infinitum. What is important about the decimal system is that it is uniform and that it uses the technique of expressing the relation between numbers by spatial position, i.e., by places. The unit 10 was chosen because people have 10 fingers. If hens were to invent a place system, it would be in units of 6.

into being. Science, as we have seen in Chapter 1, is the generalization of the relationships of things; it consists of statements of the dependence of one happening upon another. In the simpler technologies, conceptions of functional dependence were almost entirely empirical, in the sense that no symbolic formulation of generality came about. An Indian of the Amazon Basin, using his blowpipe to shoot small birds, knew from experience that there was a functional relation between the strength with which he blew air into the tube and the velocity of the dart. So too, a Plains Indian, driving arrows from his bow into a herd of buffalo in the surround, could make an analogous observation. But such an observation remains a technological one; it does not become scientific until some general relationship between tensile strength and velocity has been worked out by measurement. Obviously, neither an Arawak nor an Omaha would need such an equation. The maker of the bow or the blowpipe might conceivably require such knowledge. If the bow is not strong enough, it will break; if the diameter of the blowpipe is too large, sufficient velocity cannot be attained. When people begin to make rules of thumb to express these relationships, then we find the beginning of science.

In the cases just mentioned, there is no evidence to indicate that the people in question made even a rough formulation in terms of units of measurement. In other cases, however, there is reason to believe that scientific generalizations did exist. For example, most of the expert canoemen among the Indians of the boreal forests in Canada and Alaska can and do formulate simple equations to describe the fact that the distance a crew can travel on a river in one day depends on whether they are traveling up or down stream, how heavily the canoe is loaded, and how many men there are to paddle it. In terms of these variables they can predict how many sleeps it will take a given crew to travel a given distance on a given stretch of river. Precepts of this kind are the common knowledge of many groups.

In many cases, the functional relationships so assumed are only partially true, or even erroneous. This is especially the case with the formulations of astronomical phenomena, many of which are simple coincidences, such as the belief of the Andamanese that killing the cicada brought about night. As we have previously stated, associations of this type are derived wholly from the fact that the two phenomena thought to be linked both happen to be elements in a single context of situation. Nevertheless, many scientific observations have actually developed from such simple associations, in cases where a true functional relation also happens to exist. The blacksmith in Africa, for example, who is engaged in forging iron, knows

when he has heated the bloom to the right temperature by observing its color. In this case, experimentation would show that the relationship of temperature to plasticity as measured by color is fairly accurate. In the same way, simple experiment would have shown no relationship between cicadas and night.

The rudiments of science only exist, therefore, when explicit relationships of functional dependence, that is, of predictability, begin to become part of the knowledge of a group. Their occurrence, in most of the societies we have studied, is only sporadic, like that of the distance a crew of canoemen can travel, previously mentioned. The existence of scientific method, by which we mean the application of the technique of seeking out relationships of functional dependence systematically, is, of course, only to be found in the higher civilizations where number and measurement are commonplace parts of the technological systems. In this sense, science is experimental; it does not consist of the detailed descriptions of objects and places. An Australian aborigine knows intimately every square rod of his horde's hunting territory, and his knowledge of its surface configuration, fauna, flora, and seasonal changes of climate will be as accurate as that of any scientist. The difference between them is that the scientist is able to abstract the generalities from all these particular elements, and he can show the dependence of one happening upon another. He can do this because his symbols have precise referents, and his techniques of observation (measurement) enable him to determine just how these referents are interrelated.

Scientific method, therefore, is a level of symbolization more complex than that inherent in technological systems. It involves the relations of symbols, that is, of the properties which many different objects have in common. These properties may be weight, or velocity, or temperature, or activity rate. They can be determined only when units of measurement have been worked out. In the further process of the definition of the relations of functional dependence, it becomes necessary to refine the methods of measurement by which the process started. Greater accuracy of measurement very often brings about the redefinition of relationships. It is only when these methods are systematically understood, that it is possible to extend scientific procedures to phenomena in which the units of measurement are not given within the technology of the people. This is the reason why the physical sciences have been the first to develop, as we pointed out in Chapter 1, and the science of human relations has been the last. It was only when units of measurement for the relations of people could be devised that it was possible to speak of a "science of human relations." The measurement of the time of people's activities could only arise in a society

where time was the controlling element in the operation of human institutions.

SUMMARY

Science arises when people are able to abstract from their technical processes generalizations about the properties of phenomena, as determined by measurement of the relations between them. The symbols and techniques of science have developed out of technology by the same process of abstraction that we have already seen in ritual, language, and other symbolic configurations.

Science is based upon the relations between measurements, mathematics upon the relations between numbers. In simple technologies technical operations can be performed without the need of accurate measurement, other than number. We use the plural as an indefinite number; the simplest people cannot count above 3, 6, 10, or whatever, and the plural serves as the indication of all numbers above this limit. All who can count to 10 or over use the decimal system, or some units of it, because we have 10 fingers. The duodecimal system, employing 12, comes from Babylonia, and perhaps was used because there are 12 months in a year and perhaps also because of the ease of packing and handling standard-sized objects by groups of 12 in containers.

People measure time by the regular recurrence of events, in days, moons, years. This is sufficient for people with simple technologies in most environments. In equatorial environments with seasonal rains, a device called the gnomon is commonly used by agriculturalists. By measuring the length of the sun's shadow with this every day during the proper season they can determine the exact day on which to start their farming so as get their seeds in before the rains come. In complex, urban societies where accurately timed interaction is needed, and where a finer unit than a half day is needed for keeping appointments, measurements of hours have arisen, as in Egypt and Babylonia. Some peoples at a complex level also have devised long cycles, comparable to our centuries, using not only the sun and moon but also Venus, Sirius, and other planets and stars. From the ability to predict recurrent events by astronomy and other methods of time measuring, specialists have tried to apply these techniques to all kinds of events which have no functional relation to the movements of the celestial bodies; this is astrology, a form of magic.

In the more primitive societies, distance is usually measured in linear terms only, by landmarks of the body, such as the span, cubit, and foot, without standardization. Area is expressed in terms of length, with an

assumption of equal or constant breadth; volume in terms of familiar containers.

The history of the development of standards of measurement provides one of the best scales for the evaluation of human culture, which can on this basis be divided into stages of no units other than numbers, unstandardized units, standard units with several standards, and a single standard in all spatial measurements, which is the metric system.

Science is the generalization of the relation of phenomena; it consists of statements of the dependence of the occurrence of one phenomenon on that of another. In the societies with simple technologies, ideas of these relationships exist, but they are not science until they have been worked out by measurement. In some cases the supposed relations are not cases of functional dependence at all but merely the coincidental occurrence of two phenomena in the same context of situation. The scientific method is only to be found in the more complex civilizations and depends on the refinement of techniques of measurement. The physical sciences were the first to emerge because there was a need for accuracy of measurement and knowledge of functional relationships in technology. The science of human relations, in which the units of measurement are not apparent elements in the technology of any people, has been the last to be discovered.

CHAPTER 30

Conclusion

In the preceding chapters we have tried to give the reader a systematic description of the basic principles of the science of human relations. In so doing we have followed the operational method in use in the other natural sciences, and we have also tried to show how the use of these methods enables us to obtain rational explanations of simple and complex phenomena alike. Throughout the book our analysis has been based on two associated assumptions: that man is an organism, and that the adjustment of one individual to others can be explained in terms of known facts of physiology.

This process of adjustment, which is called interaction, derives from the properties of organisms—that they act spontaneously, and that these actions provide the stimuli to which other organisms act in response. In the case of man, the structure of the cortex is such that complex stimulus-response patterns are possible through the mechanism of conditioning, and among the most important of these patterns are the techniques by which people adapt themselves to their environments, and which make up their technologies.

The performance of these techniques, however, requires interaction between individuals, and as people become conditioned to specific techniques necessary for their continued existence, they build up human institutions, within which the component interaction becomes habitual and assumes the characteristics of a system.

We may, on this basis, define anthropology as a natural science concerned with the study of human relations. These relations, which are the product of physiological mechanisms and which combine individuals into groups and institutions, are controlled by the techniques, habits, and symbols to which we are conditioned, and which make up the content of our culture.

This capacity for conditioning is also the reason why human culture is cumulative, why new techniques can be added to those already used as one generation teaches its habits and practices to another. Human history is a record of continuous change in the adjustments of people and of institu-

tions, of continuous shiftings of states of equilibrium. Some of these changes in the equilibrium of societies have been due to initial changes in the environment, such as the advance and retreat of glaciers, the rising of shore lines, and the eruption of volcanoes. Others have been due to the invention or introduction of new techniques, like Edison's invention of the electric light, or the acquisition of the horse by the Plains Indians. Some have been due to the rise of single individuals with the personalities of leaders, who have brought about lasting or non-repetitive changes in the adjustments of peoples, like Christ or Buddha or Alexander the Great. Others have been initiated by the impact of one people on another, like the changes in the life of the American Indians brought about by the arrival of the white men.

From the existing evidence it seems clear that the history of mankind throughout the world and throughout the time of which we have knowledge has followed a linear progression in two respects: (1) The complexity of human technology has increased, so that men have been able to utilize more and more the resources of the terrestrial environments. (2) Human relations and hence human institutions have also increased in complexity, as a function of the increase in the complexity of technology. This linear progression does not mean that the basic forms of human interaction have been altered, or that "human nature" has been changed. These are constant factors which are always present, and without which human society could not develop.

Because anthropology, as we have seen, regards man as a whole, it can provide a unifying center around which a science of human relations can grow. The technological problems which plagued the people of an earlier day, problems of food and shelter and health, of more efficient means of transportation and communication, have largely been solved. We can look forward to increasing technical triumphs provided we are able to master the maladjustments in human relations resulting from technological change. At the present time, little attempt is made even to use what we already know in dealing with such problems. Only when the science of human relations becomes as fully developed as the older natural sciences can we hope to eliminate sources of individual maladjustment, bring about harmonious relations between the many groups making up a single nation, work out more effective and democratic systems of government, and extend their sway to the relationships between nations. Only with such a science can the basic problem of our civilization be solved,—how to increase our human adjustment and at the same time to increase our technological efficiency.

APPENDIX I

Note on the Reading Lists

The Reading List which follows contains individual chapter assignments in outside reading, a list of numbers referring to titles in The Supplementary Reading List, or both. The only exception is Chapter 18, which does not require outside reading. The reading list is designed to supplement the text if the instructor so wishes. Many of the assignments are taken from outside the conventional field of anthropology, as it is defined by most scholars. This has been done in order to implement the point of view from which this book is written and to indicate the broad application of anthropology to daily life.

The Supplementary Reading List consists of fifty titles of monographs in the field of anthropology in its conventional sense, and twenty titles of novels, books of travel, etc., chosen to represent as wide a variety of societies and subjects as possible. In selecting these books we have been governed by the following principles: to assign only books written in English; to select works that are relatively available or easily obtained; to cover all major areas of the earth's surface, all types of technology, and all levels of institutional complexity; to limit the list to books that stress factual reporting and avoid theoretical reconstructions; and to give the student the opportunity to analyze social materials at various levels of abstraction.

The books on The Supplementary Reading List may be read in conjunction with the chapter assignments, as indicated by the italicized numbers; they may be assigned separately, or may be disregarded.

READING LIST: INDIVIDUAL CHAPTER ASSIGNMENTS [1]

PART I

Chapter 1. Bridgman, Percy, *The Logic of Modern Physics,* N. Y., 1928 (Macmillan), whole book, or Chapters 1 and 2.

[1] The italicized numbers which accompany the assignment for some chapters represent titles in The Supplementary Reading List.

Chapter 2. Cannon, W. B., *Bodily Changes in Fear, Hunger, Pain, and Rage,* N. Y., 1936 (Norton).
or Dent, J. Y., *The Human Machine,* N. Y., 1937 (Knopf).
or Clendenning, L., *The Human Body,* N. Y., 1927 (Knopf).

Chapter 3. Pavlov, I., *Conditioned Reflexes,* translated by G. V. Anrep, Oxford, 1927.

Chapter 4. Noyes, A. P. *Modern Clinical Psychiatry,* Phila., 1935 (Saunders).

PART II

Chapter 5. James, P. E., *An Outline of Geography,* Boston, 1935 (Ginn).
Whittlesey, D., *Major Agricultural Regions of the Earth,* Annals of the Assn. of Am. Geographers, Vol. XXVI, No. 4, 1936, pp. 199-240 (printed separately).

Chapter 6. *6, 16, 30.*

Chapter 7. Forde, C. Darryl, *Habitat, Economy, and Society,* London, 1934 (Methuen), Part I and Chapter 18. *10, 15, 17, 37, 43, 52.*

Chapter 8. Forde, C. Darryl, same, Chapters 19-22 (rest of book). *7, 12, 21, 29, 32, 33, 44, 50.*

Chapter 9. Goodwin, A. J. H. *Communication Has Been Established,* London, 1937 (Methuen). *54, 56, 62, 68, 69.*

Chapter 10. Thurnwald, R., *Economics and Primitive Communities,* Oxford, 1932 (International Institute for African Studies).

Chapter 11. Febvre, L., *A Geographical Introduction to History,* N. Y., 1925 (Knopf, History of Science Series).

PART III

Assignment for Part III as a Whole: Beard, Miriam, *A History of the Business Man,* N. Y., 1938 (Macmillan).

Chapter 12. *1, 4, 26, 34, 59, 60, 70.*

Chapter 13. *12, 13, 17, 21, 32, 34, 37, 55.*

Chapter 14. *28, 33, 36, 39, 42, 48, 53, 55, 61, 65, 66.*

Chapter 15. *15, 25, 35, 48, 57, 67.*

Chapter 16. *3, 19, 42, 48.*

Chapter 17. *17.*

Chapter 18. No assignment, no supplementary reading.

PART IV

Chapter 19. Walpole, Hugh, *Semantics,* N. Y., 1941 (Norton).
Malinowski, B., "Supplement I" in Ogden, C. K., and
Richards, I. A., *The Meaning of Meaning,* N. Y., 1930 (Harcourt, Brace).
Students wishing to go further in this subject are advised to read *The Meaning of Meaning* itself.

Chapter 20. *19, 23, 24, 31, 34, 42.*
Chapter 21. *17, 23, 24, 42.*
Chapter 22. *11, 15, 19, 27, 38, 42, 46.*
Chapter 23. *17, 31, 40, 49.*

PART V

Chapter 24. Bloomfield, L., *Language,* N. Y., 1933 (Holt).
or Sapir, E., *Language,* N. Y., 1921, 1939 (Harcourt, Brace).
Chapter 25. Prall, D. W., *Aesthetic Analysis,* N. Y., 1936 (Crowell).
Richards, I. A., *Principles of Literary Criticism,* N. Y., 1926 (Harcourt, Brace). *9.*
Chapter 26. *42.*
Chapter 27. *25.*
Chapter 28. Holmes, O. W., *The Common Law* (original ed., 1881). *2, 20, 42.*
Chapter 29. Hogben, Lancelot, *Science for the Citizen,* N. Y., 1938 (Knopf). Selections to be made by instructor.
Bell, E. T., *The Handmaiden of the Sciences,* N. Y., 1937 (Reynal & Hitchcock).

SUPPLEMENTARY READING LIST

A. Fifty Selected Monographs

1. Arensberg, C. M., and Kimball, S. T., *Family and Community in Ireland,* Cambridge, Mass., 1940.
2. Barton, R. M., *Ifugao Law,* U. of Cal. Pubs. in Am. Arch. & Ethnol., Vol. 15, No. 1, 1919.
3. Barton, R. M., *Philippine Pagans,* London, 1938.
4. Blackwood, Beatrice, *Both Sides of Buka Passage,* Oxford, 1935.
5. Boas, Franz, *The Central Eskimo,* BAE 6th Ann. Report, Washington, 1888.
6. Boas, Franz, *The Kwakiutl of Vancouver Island,* AMNH Mem. Vol. 8, Part 2, 1909.
7. Bogoras, V. G., *The Chukchee,* AMNH Mem. Vol. 11, 1904-1909.
8. Coon, C. S., *Tribes of the Rif,* Harvard African Studies, Vol. 9, 1931.
9. Covarrubias, Miguel, *Island of Bali,* N. Y., 1937 (Knopf).
10. Ekblaw, W. E., *The Material Response of the Polar Eskimo to their Far Arctic Environment,* Annals of the Assn. of American Geographers, 1927-28 (separate).
11. Evans-Pritchard, E. E., *Witchcraft, Oracles, and Magic among the Azande,* N. Y., 1937 (Oxford Press).
12. Evans-Pritchard, E. E., *The Nuer,* Oxford, 1939.
13. Fei, H. T., *Peasant Life in China,* London, 1939 (Routledge).
14. Firth, Raymond, *Primitive Polynesian Economy,* London, 1939.

15. Firth, Raymond, *Primitive Economics of the New Zealand Maori,* N. Y., 1929.
16. Firth, Raymond, *We, the Tikopia,* London, 1936.
17. Fletcher, Alice, and LaFlesche, Francis, *The Omaha Tribe,* BAE Washington, Annual Report, Vol. 27, 1911.
18. Gorer, Geoffrey, *Himalayan Village,* London, 1938.
19. Herskovits, M. J., *Dahomey,* N. Y., 1938, 2 vols.
20. Hogbin, H. I., *Law and Order in Polynesia,* London, 1934.
21. Homans, G. C., *English Villagers of the Thirteenth Century,* Cambridge (Mass.), 1940.
22. Junod, H. A., *The Life of a South African Tribe,* London, 1927, 2 vols. (Macmillan).
23. Karsten, Rafael, *The Head-Hunters of the Western Amazonas,* Helsinki, 1935.
24. Landtmann, Gunnar, *The Kiwai Papuans of British New Guinea,* London, 1927.
25. Malinowski, Bronislaw, *Argonauts of the Western Pacific,* London, 1922 (Geo. Allen & Unwin).
26. Malinowski, Bronislaw, *The Sexual Life of Savages,* London, 1929.
27. Malinowski, Bronislaw, *Coral Gardens and their Magic,* London, 1935 (Geo. Allen & Unwin).
28. Morgan, L., *League of the Ho-de-no-sau-nee, or Iroquois,* New Edition, N. Y., 1901 (Dodd, Mead).
29. Musil, Alois, *Manners and Customs of the Rwala Bedouins,* Oriental Explorations and Studies of the Am. Geogr. Society, No. 6, N. Y., 1928.
30. Osgood, Cornelius, *Ingelik Material Culture,* New Haven, 1940, Yale U. Publs. in Anth., No. 22.
31. Radcliffe-Brown, A. R., *The Andaman Islanders,* Cambridge, 1922.
32. Redfield, Robert, and Villa, A. R., *Chan Kom, a Maya Village,* Washington, 1934 (Carnegie Inst. Pub. No. 448).
33. Richards, Audrey, *Land, Labour, and Diet in Northern Rhodesia,* Oxford, 1939.
34. Rivers, W. H., *The Toda,* London, 1906.
35. Roethlisberger, F. J., and Dickson, W. J., *Management and the Worker,* Cambridge (Mass.), 1940.
36. Roscoe, John, *The Baganda,* London, 1911.
37. Schapera, I., *The Khoi-San Peoples of South Africa,* London, 1930.
38. Seligman, C. G. and B. Z., *The Veddas,* Cambridge, 1911.
39. Seligman, C. G. and B. Z., *Pagan Tribes of the Nilotic Sudan,* London, 1932.
40. Speck, Frank, *Naskapi,* Norman, Okla., 1935 (U. of Okla. Press).
41. Spier, Leslie, *Havasupai Ethnography,* AMNH-AP, 1928.

42. Stephen, A. M., *Hopi Journal,* Edited by Elsie Clews Parsons, New York, 1936.
43. Stewart, Julian, *Basin-Plateau Aboriginal Socio-Political Groups,* Bull. No. 120, BAE, Smithsonian Inst., Washington, 1938.
44. Turi, Johan, *Turi's Book of Lappland,* London, 1931 (Cape).
45. Warner, W. L., *A Black Civilization,* N. Y., 1937.
46. Williams, F. E., *Orokaiva Magic,* Oxford, 1928.
47. Williams, F. E., *Orokaiva Society,* Oxford, 1930.
48. Williamson, R. W., *The Social and Political Systems of Central Polynesia,* Cambridge, 1924, 3 vols.
49. Williamson, R. W., *Religious and Cosmic Beliefs of Central Polynesia,* Cambridge, 1933, 2 vols.
50. Wilson, G. L., *Agriculture of the Hidatsa Indians,* U. of Minn. Studies in the Social Sciences, Minneapolis, 1917.

B. Twenty Selected Novels, Travel Books, and Other "Popular" Works

51. ———, *The Book of the Thousand Nights and One Night,* any complete, authoritative edition. First choice: John Payne's translation; second, Burton's.
52. Arseniev, V. K., *Dersu the Trapper,* N. Y., 1941 (Dutton).
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Glossary

age grading: a type of family organization in which the age set has the highest frequency and in which individuals are organized into age groups rather than generations.

analytic: a class of languages in which unit symbols are rarely combined into words and in which the sentence is of primary importance.

annuals: plants which die each year, leaving seed to germinate at the beginning of the next growing season.

antagonism (of symbols): the relation between symbols which refer to different activities or institutions which cannot operate simultaneously without producing an upset of equilibrium. Hence these symbols cannot be used in the same context without also producing an upset.

artifact: an implement or object made by man.

associations: institutions which arise around tangent relations.

autonomic (nervous system): that part of the nervous system which controls the involuntary activities of the body.

auxiliary: an association made up of individuals who form tangent relations to one another through relatives who are members of another association. It is this latter association to which the institution in question is auxiliary.

avoidance, rules of: the practice of interacting with specific relatives at as low a frequency as possible.

broadleaf: a synonym for angiosperm, that type of plant whose seed is covered and can be spread and germinated without the direct action of water. Typical broadleaves are oak, maple, elm, and birch.

caste: a type of institution formed upon tangent relations, and hence an association, which develops into a family institution through endogamy. Therefore a caste is both an association and an extended family. It ordinarily occurs in class systems, as in India.

clan: an extended family, membership in which is dependent upon descent from a common male or female ancestor, or the fiction thereof. The members of a clan form an isolated system.

class: a group of individuals who occupy the same position in a set.

class system: the segmentation of a society into several groups, cross-cutting all

other institutions. The members of each class have a fixed position in a set, and all upper-class members originate action to all below them.

clique: any group of individuals in interaction which is not an institution.

commercial: a society in which the majority of individuals who practice occupations are specialists.

common law: any law which is based upon precedent.

conditioned response: the modification of an inherited response pattern so that it is activated only by differentiated stimuli.

conditioning: the learning process—the process of developing conditioned responses.

configuration (symbolic): a group of symbols related to one another through the interrelation of their referents.

contagious magic: ritual techniques in which the symbols obtain their meaning from physical juxtaposition.

context of situation: any combination of objects, activities, places, climatic conditions, etc., which accompany an event (interaction) between people.

cortex: the cerebral hemispheres of the brain in which the patterns of conditioned responses are set up.

crisis: any sudden change in the interaction rates of individuals in institutions.

cross-cousin (ordinarily referring to a type of marriage): the children of siblings of opposite sex are called cross-cousins.

custom: any rule symbolizing a pattern of interaction limited to a single institution or part of an institution.

emblemization: the process by which one aspect of a symbol becomes its principal diagnostic and must always occur in juxtaposition with the symbol itself.

endogamy: marriage between individuals within the group.

equilibrium: that state of a system such that when a small force is impressed upon it, a change takes place within it, and once this force is removed the system returns to approximately its previous state.

equivalence (of symbols): that state in which two symbols have the same referent and hence may be substituted for one another.

event: a continuous sequence of interaction between two or more individuals.

exogamy: marriage between individuals belonging to different groups.

family (extended): a group made up of two or more related unit families.

family (immediate): see **family** (unit).

family (unit): a group consisting of father, mother, and children.

fissure line: a line of cleavage which extends between two classes in a set, and which is marked by a low frequency of interaction.

functional dependence: that relationship between variables in which the value of one changes uniformly with changes in the values of another: $y = f(x)$.

fundament: that portion of the landscape which is unaltered by human activity.

gathering: methods of obtaining raw materials from the landscape without the use of husbandry.

gens, gentes (pl.): a clan in which membership is inherited through the male line.

group: two or more individuals in interaction.

group event: see **set event.**

hierarchy: a set containing more than two classes.

husbandry: the production, use, or both, of animals and plants in a state of domestication.

hypothalamus: that part of the brain which controls the autonomic nervous system. See Fig. 2.

imitative magic: ritual techniques in which the symbols used are derived from non-ritual activities.

incest: sexual intercourse between members of a family, between whom this form of interaction is prohibited.

incorporation: the third stage of rites of passage or intensification in which the participants resume their habitual interactions.

institution: a system of sets in equilibrium. For a full definition, see page 287.

interaction: that situation in which the actions of one individual are followed by the actions of another.

interaction rate: the quantitative properties of an individual's interaction. For a full definition, see page 51.

joking relationship: see **privileged familiarity.**

junior levirate: a form of levirate in which the marriage is limited to younger brothers of the deceased husband.

law: any rule symbolizing a pattern of interaction which applies to all the members of a group, regardless of institutions.

levirate: a marriage between a man and his brother's widow.

lineage: any extended family in which membership is not unilaterally determined.

magic: the technique of ritual.

matrilineal: reckoning descent through the mother.

moiety: one of two mutually exclusive divisions of a group.

mumi: a Siwai term for a leader.

operation: a technique of measuring the relations of phenomena.

origin of action: that action which begins interaction; the first action in a sequence.

pair event: an event between two individuals.

parallel cousin: the children of siblings of the same sex.

parasympathetic: that division of the autonomic nervous system which controls the repetitive involuntary activities of the body.

particularistic: a class of languages in which the polysynthetic tendency is carried to an extreme.

patrilineal: reckoning descent through the father.

perennials: plants which live through several annual growing seasons.

phratry: one of three or more mutually exclusive divisions of a group, made up

of one or more clans. When there are but two phratries, the term moiety is used instead.

phoneme: any unit of sound used in speech which has symbolic significance.

polyandry: the marriage of two or more men to one woman.

polygamy: a term used to include polyandry and polygyny.

polygyny: the marriage of two or more women to one man.

polysynthetic: a class of languages in which radical and relational symbols are characteristically combined into complex words and in which the sentence is relatively unimportant.

privileged familiarity: the practice of interacting with specific relatives at a high frequency.

radical symbols: words or parts of words which symbolize specific individuals, objects, or relationships.

reciprocal relationship: a relation between two persons in which every origin of action by one person is balanced by an origin of action from the other.

reinforcement (of a symbol): the repetition of the interaction which forms the referent for any symbol.

referent: that to which a symbol refers.

relational symbols: words or parts of words which refer to the relations between radical symbols.

rites of intensification: ritual performed in response to a crisis which arises from changes affecting all the members of a group in concert.

rites of passage: ritual performed in response to a crisis which arises from changes specifically affecting a single individual.

ritual: a symbolic configuration used to restore equilibrium after a crisis.

ritual symbol: any symbol which refers to the relations between individuals in their practice of ritual techniques.

ritual technique: any technique employed in a rite of passage or of intensification.

savanna: low-latitude grasslands.

semi-commercial: a society in which the percentage of specialists is above a minimum.

secret society: any association in which a high degree of isolation from other institutions is enforced while interaction is taking place.

separation: the reduction of interaction in other institutions which characterizes the first step in a rite of passage or of intensification.

set: a group of individuals who interact in set events arranged in such a way that some of the members only originate action and others only terminate it. See page 283.

set event: an event between three or more individuals in which one person originates to the others.

shaman: a religious leader.

sibling: a term used to include both brothers and sisters.

society: a group of individuals interacting in two or more institutions, all of whom are members of the most inclusive institution. In rare cases of isolation a single institution may constitute a society.

sororate: a marriage between one man and two or more sisters.

specialist: an individual who practices a technique, either part or full time, different from those practiced at the same time, by other individuals of the same age and sex who are members of his group.

spontaneous activity: that activity of an organism which is manifested when it is placed in an environment in which all external stimuli remain constant.

staff line: a set of relations which occur between processing and non-processing departments of an institution.

statute law: any law which is based upon legislative action.

subsistence: a society in which specialization is absent and trade at a minimum.

symbiotic: a society in which all working members practice the same specialty.

symbol: any object, person, condition, element of speech, etc., which sets off a conditioned response.

symbolization: the process by which symbols are formed.

sympathetic: that division of the autonomic nervous system which controls the responses of the body to sudden disturbances.

synchronization (in interaction): a property of interaction in which the action of one individual follows the action of another continuously, without interruptions or failures to respond.

synthetic: a class of languages in which relational symbols are combined with unit symbols into single words and in which the significance conveyed by single words is moderately frequent.

system: a group of individuals interacting with each other at a higher frequency than with non-members when the system is in operation.

tabu: a Polynesian word implying the prohibition of specific patterns of interaction.

tangent institutions: two institutions are tangent when they have a member in common.

tangent relation: any relation between two individuals in different institutions who are related to an individual who is a member of both.

technology: the combination of techniques common to a group.

terminus: the person who responds to an origin of action.

totem: any ritual symbol which does not refer to a society.

transition: the increase of interaction in a new system which marks the second or intermediate stage of a rite.

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